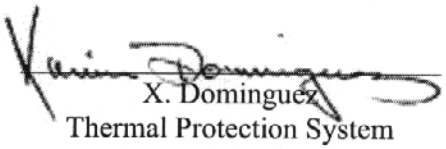
FE-058 KLO-02-001

Mission STS-104
OV-104 Flight 24
Thermal Protection System
Post-Flight Assessment

March 2002

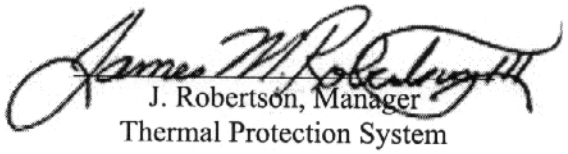
P .O. 1970483303

Prepared by:



X. Dominguez
Thermal Protection System
Orbiter Engineering

Approved by:



J. Robertson, Manager
Thermal Protection System
Orbiter Engineering

BOEING®

This page intentionally left blank.

Mission STS-104

OV-104 Flight 24

Thermal Protection System Post-Flight Assessment

This page intentionally left blank.

Table of Contents

Table of Contents (*cont'd*)

List of Tables

List of Figures

List of Photographs

List of Photographs (*cont'd*)

List of Acronyms and Definitions

AETB-8	Alumina-Enhanced Thermal Barrier - 8 pcf
DFRC	Dryden Flight Research Center
DHS	Dome Heat Shield
EO	Engineering Order
EOTF	Engineering Order to Follow
ET	External Tank
FI	Flexible Insulation
FRCI-12	Fibrous Refractory Composite Insulation - 12 pcf
FRCS	Forward Reaction Control System
FRSI	Felt Reusable Surface Insulation
HRSI	High-Temperature Reusable Surface Insulation
IML	Inner Mold Line
Keq	Normalized Equivalent Roughness
LESS	Leading Edge Structural Subsystem
LI-900	Lockheed Insulation - 9 pcf
LRSI	Low-Temperature Reusable Surface Insulation
MCR	Master Change Record
MLGD	Main Landing Gear Door
MR	Material Review
NLGD	Nose Landing Gear Door
OMI	Operations and Maintenance Instruction
OML	Outer Mold Line
OMRSD	Operations and Maintenance Requirements and Specifications Document
OMS	Orbital Maneuvering System
pcf	Pounds Per Cubic Foot
PLBD	Payload Bay Door
PPE	Personal Protective Equipment
PR	Problem Report
PRT	Problem Resolution Team
RCC	Reinforced Carbon-Carbon
RSI	Reusable Surface Insulation
RTV	Room-Temperature Vulcanized

List of Acronyms and Definitions (*cont'd*)

SiC	Silicon Carbide
SIP	Strain Isolator Pad
SSME	Space Shuttle Main Engine
TUFI	Toughened Uni-Piece Fibrous Insulation
WLE	Wing Leading Edge

Acknowledgment

Several personnel contributed to this report. The engineering inspections were performed at Kennedy Space Center Shuttle Landing Facility by Xavier Dominguez and Jeremy Brand, and in Orbiter Processing Facility High Bay Number 3 at the Kennedy Space Center by Xavier Dominguez, as well as the authors noted. Preflight data was provided by SFOC personnel. Flight temperature data was provided by Jerry Kinder, Boeing Huntington Beach. Post-landing debris assessment was provided by the Debris Inspection Team. Publication and editorial assistance was provided by L. Koenig and K. Cochran. The assistance of all who helped prepare this report is greatly appreciated.

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 1. Overall View, Right Hand Side

This page intentionally left blank.

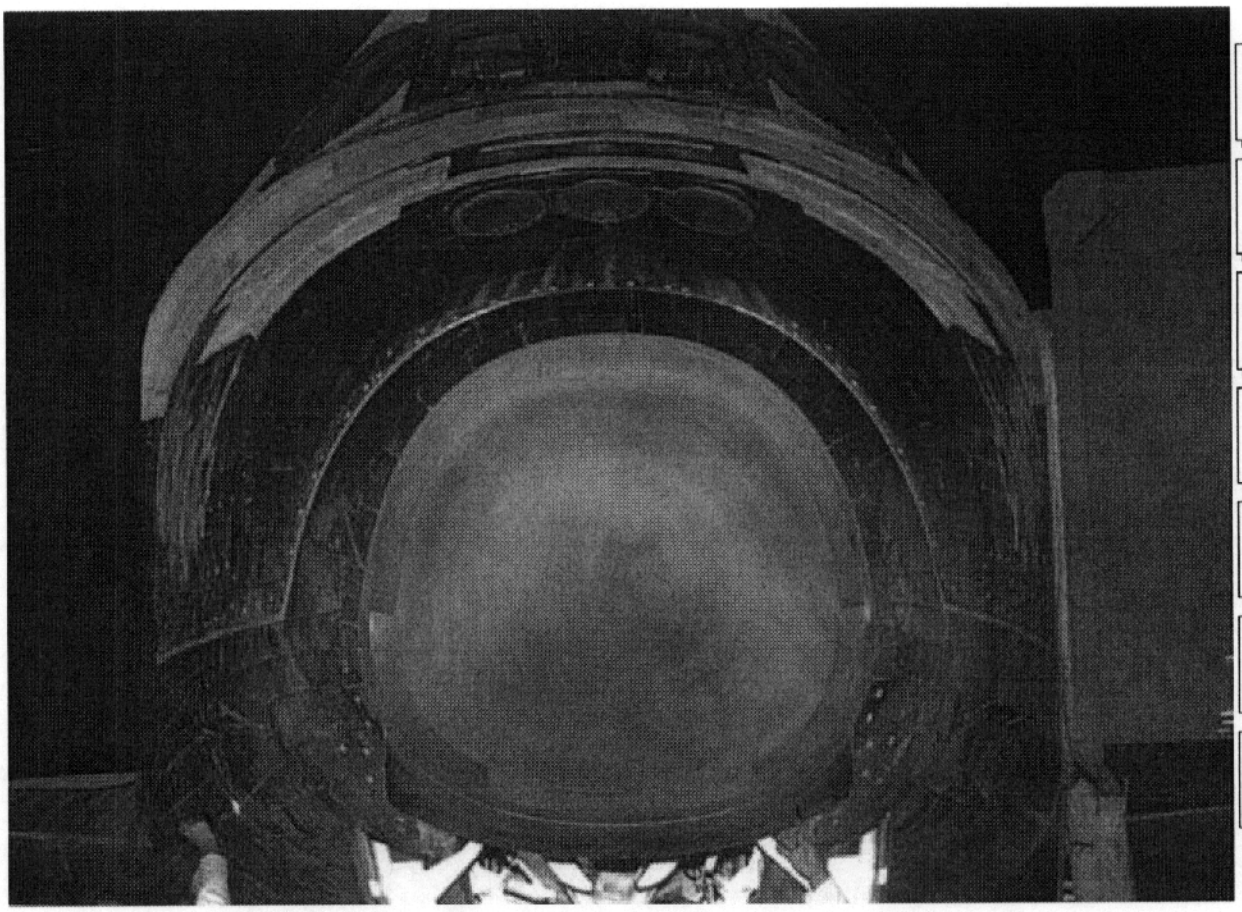
Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 2. Overall View, Left Hand Side

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

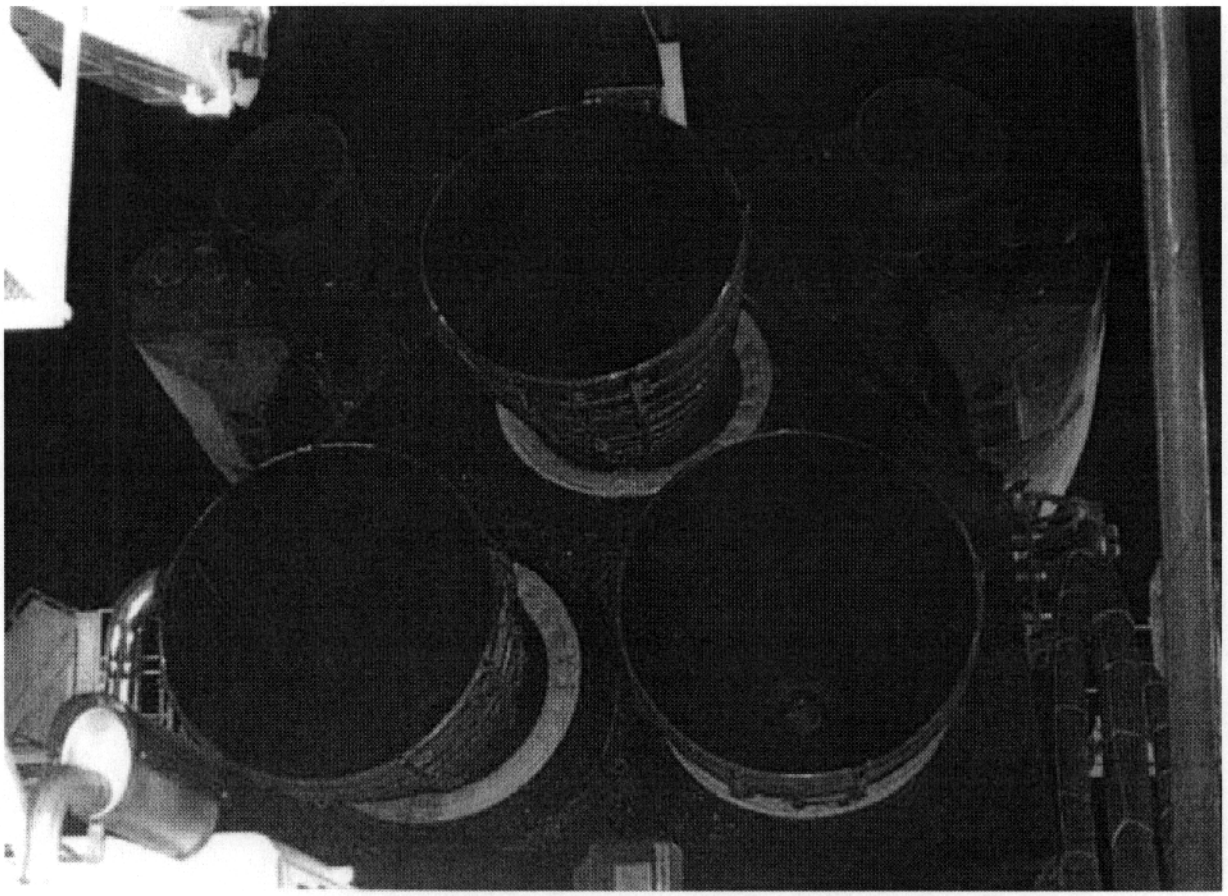


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 3. Overall View, Front

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 4. Overall View, Aft

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

1.0 PURPOSE

This report summarizes the results of engineering inspections conducted on the orbiter TPS following flight 24 of OV-104.

2.0 BACKGROUND

The previous flights of OV-104 and the associated report numbers are documented in table 1.

Table 1. Flight History

MISSION NUMBER	FLIGHT NUMBER	LAUNCH DATE	LANDING DATE	REPORT NUMBER
STS-28	104/1	10-03-85	10-07-85	LS085-009
STS-31	104/2	11-26-85	12-03-85	LS085-011
STS-27R	104/3	12-02-88	12-06-88	KLO-89-001
STS-30R	104/4	05-04-89	05-08-89	KLO-89-003
STS-34	104/5	10-18-89	10-23-89	KLO-89-005
STS-36	104/6	02-28-90	03-04-90	KLO-90-005
STS-38	104/7	11-15-90	11-20-90	KLO-90-009
STS-37	104/8	04-05-91	04-11-91	KLO-91-002
STS-43	104/9	08-02-91	08-11-91	KLO-91-016
STS-44	104/10	11-24-91	12-01-91	KLO-91-021
STS-45	104/11	03-24-92	04-02-92	KLO-92-005
STS-46	104/12	09-31-92	08-08-92	KLO-92-010
STS-66	104/13	11-03-94	11-14-94	KLO-95-003
STS-71	104/14	06-27-95	07-07-95	KLO-95-006
STS-74	104/15	11-12-95	11-20-95	KLO-96-002
STS-76	104/16	03-22-96	03-31-96	KLO-96-007
STS-79	104/17	09-16-96	09-26-96	KLO-96-011
STS-81	104/18	01-12-97	01-22-97	KLO-97-004
STS-84	104/19	05-15-97	05-24-97	KLO-97-007
STS-86	104/20	09-25-97	10-06-97	KLO-98-004
STS-101	104/21	05-19-00	05-29-00	KLO-00-002
STS-106	104/22	09-08-00	09-20-00	KLO-00-005
STS-98	104/23	02-07-01	02-20-01	KLO-01-004

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

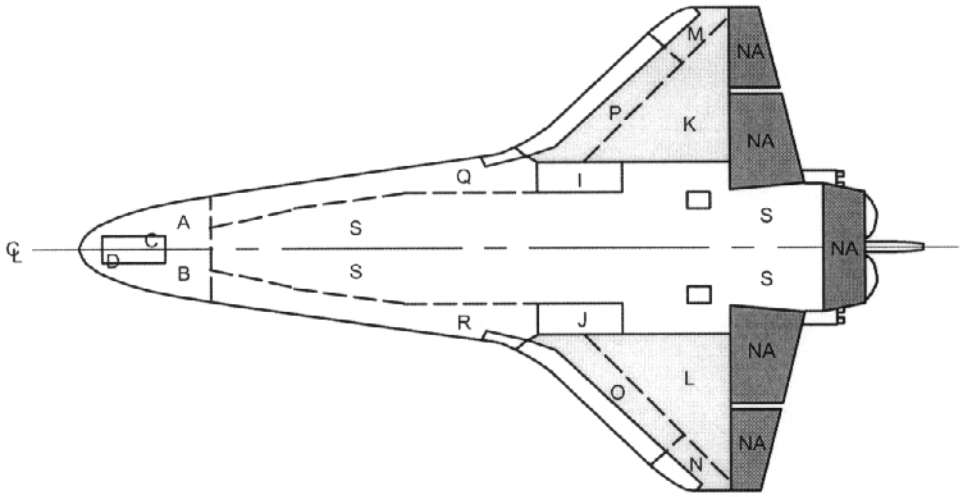
In preparation for STS-104, OV-104 and associated OMS pods had 36 tile and 20 FI blanket replacement parts installed. Of these 56 RSI components installed, 14 were related to attrition upgrade modifications (refer to table 2), and 6 of the blankets were related to the drag chute which are expendable items. Preflight vehicle roughness (Keq) values and locations are documented in table 3.

Table 2. Summary of Tile and FI Blanket Part Replacements and TPS Modifications Performed for Flight 24 of OV-104

MCR	MCR/WORK TITLE	PARTS/WORK INVOLVED	PERFORMED AT
7652	NEGATIVE MARGIN TILE REDESIGN	2 TILES REPLACED WITH NEW TILES THAT INCREASE SURFACE CONTACT BOND AREA PER REDESIGN (ATTRITION)	KSC
11451	NEGATIVE MARGIN TILE REPLACEMENT	2 TILES UPGRADED FROM LI-900 TO FRCI-12 DENSITY MATERIAL (ATTRITION)	KSC
13210	TPS-DAMAGE PRONE LRSI REPLACEMENT WITH WHITE FRCI-12/ALTERNATE RSI (ATTRITION)	1 TILE UPGRADED FROM LI-900 TO FRCI-12 DENSITY MATERIAL (ATTRITION)	KSC
14222	TPS - 6.0 LOADS NEGATIVE MARGIN TILE REDESIGN	1 TILE UPGRADED FROM LI-900 TO FRCI-12 DENSITY MATERIAL (ATTRITION)	KSC
18563	TPS - FLEET MODIFICATION MCR	4 TILES UPGRADED FROM LI-900 TO FRCI-12 FOR NEGATIVE MARGIN PURPOSE; 3 BLANKETS WERE REMOVED AND REPLACED THAT ADDS GAP FILLERS TO ALLOW CLEARANCE FOR SIP COMPRESSION (ATTRITION)	KSC
19292	NEGATIVE MARGIN TILES DUE TO PERFORMANCE ENHANCEMENT LOAD EVALUATIONS	1 TILE UPGRADED FROM LI-900 TO FRCI-12 DENSITY MATERIAL (ATTRITION)	KSC

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 3. Keq Values



NUMBER OF LOCATIONS OVER NOTED KEQ VALUES					
VEHICLE LOCATION	≤110	>110	>120	>128	>136
A	0	2	1	0	0
B	0	1	0	0	0
C	0	5	0	0	0
D	0	4	1	0	0
I	0	0	0	0	0
J	4	0	0	0	0
K	0	0	0	0	0
L	0	0	0	0	0
M	0	0	0	0	0
N	0	0	0	0	0
O	0	1	0	0	0
P	0	0	0	0	0
Q	2	0	0	0	0
R	0	0	0	0	0
S	0	0	0	0	0
KEQ TOTALS	6	13	2	0	0
PREVIOUS FLIGHT	6	24	3	0	0
OV-104 AVERAGE	45.4	19.9	34.6	13.8	3.7
FLEET AVERAGE	7.4	18.8	9.8	2.3	0.5

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

3.0 SUMMARY

(X. Dominguez)

Post-flight 24 evaluation and inspections of OV-104 revealed that the vehicle sustained more debris impacts/flight damage than the previous flight. The most notable of these damages was located adjacent to the right MLGD forward outboard corner. It is suspected that the damages occurred during door opening, thus, no adverse effects or overtemperature resulted from those damages. One location of protruding Ames was found during post-flight inspections, however, no evidence of local or downstream overtemperature was observed. A lifted/rolling leading edge FI blanket was found on the right OMS pod. Several dome heat shield blankets sustained damage that warranted removal and replacement. Overall, the general condition of the TPS system was nominal.

4.0 FLIGHT DATA

(X. Dominguez)

OV-104 was launched at 5:03 a.m. EDT on July 12, 2001 from launch pad LC-39B. The orbiter touched down at 11:39 p.m. EDT on July 24, 2001 at the KSC Shuttle Landing Facility on runway 15. For the STS-104 mission, OV-104 was assigned left OMS pod LP03 (flight 27) and right OMS pod RP04 (flight 23).

Both the number of overall debris impacts (126) and impacts over 1 inch (26) were below average when compared to previous flights for both OV-104 and the vehicle fleet (refer to tables 4 and 5, and figures 1 through 3).

There was one protruding gap filler detected post flight (refer to table 6), and two Ames gap fillers were found on the ground under the NLGD. The STS-104 reentry summary data is provided in table 7.

The structural delta and peak temperatures (refer to figure 4), Tempilabel® readings (refer to figures 5 through 10), and the boundary layer transition times (refer to table 8) indicate that the vehicle experienced a normal transition from laminar to turbulent flow. Charred filler bar history and data for this flight is shown in table 9, and current charred filler bar locations are shown in figure 11.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 4. Debris Damage Assessment Summary

	IMPACTS ≥ 1"	TOTAL
LOWER SURFACE	24	108
UPPER SURFACE	0	0
WINDOW AREA	0	14
RIGHT SIDE	0	0
LEFT SIDE	0	0
RIGHT OMS POD	0	0
LEFT OMS POD	2	4
TOTALS	**26**	**126**

Table 5. Debris Damage and Flight Comparison - OV-104 Only

MISSION	IMPACTS > 1"	TOTAL IMPACTS
STS-51J/FLT 1	17	111
STS-61B/FLT 2	55	257
STS-27R/FLT 3	298	707
STS-30R/FLT 4	56	151
STS-34//FLT 5	18	53
STS-36/FLT 6	19	81
STS-38/FLT 7	8	81
STS-37/FLT 8	10	113
STS-43/FLT 8	25	131
STS-44/FLT 10	9	101
STS-45/FLT 11	22	172
STS-46/FLT 12	22	236
STS-66/FLT 13	28	148
STS-71/FLT 14	25	164
STS-74/FLT 15	21	116
STS-76/FLT 16	15	69
STS-79/FLT 17	11	103
STS-81/FLT 18	15	100
STS-84/FLT 19	13	103
STS-86/FLT 20	31	129
STS-101/FLT 21	27	113
STS-106/FLT 22	17	105
STS-98/FLT 23	13	102
STS-104/FLT 24	26	126
OV-104 AVERAGE	**33.4**	**148.8**
FLEET AVERAGE	**30.7**	**145.8**

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

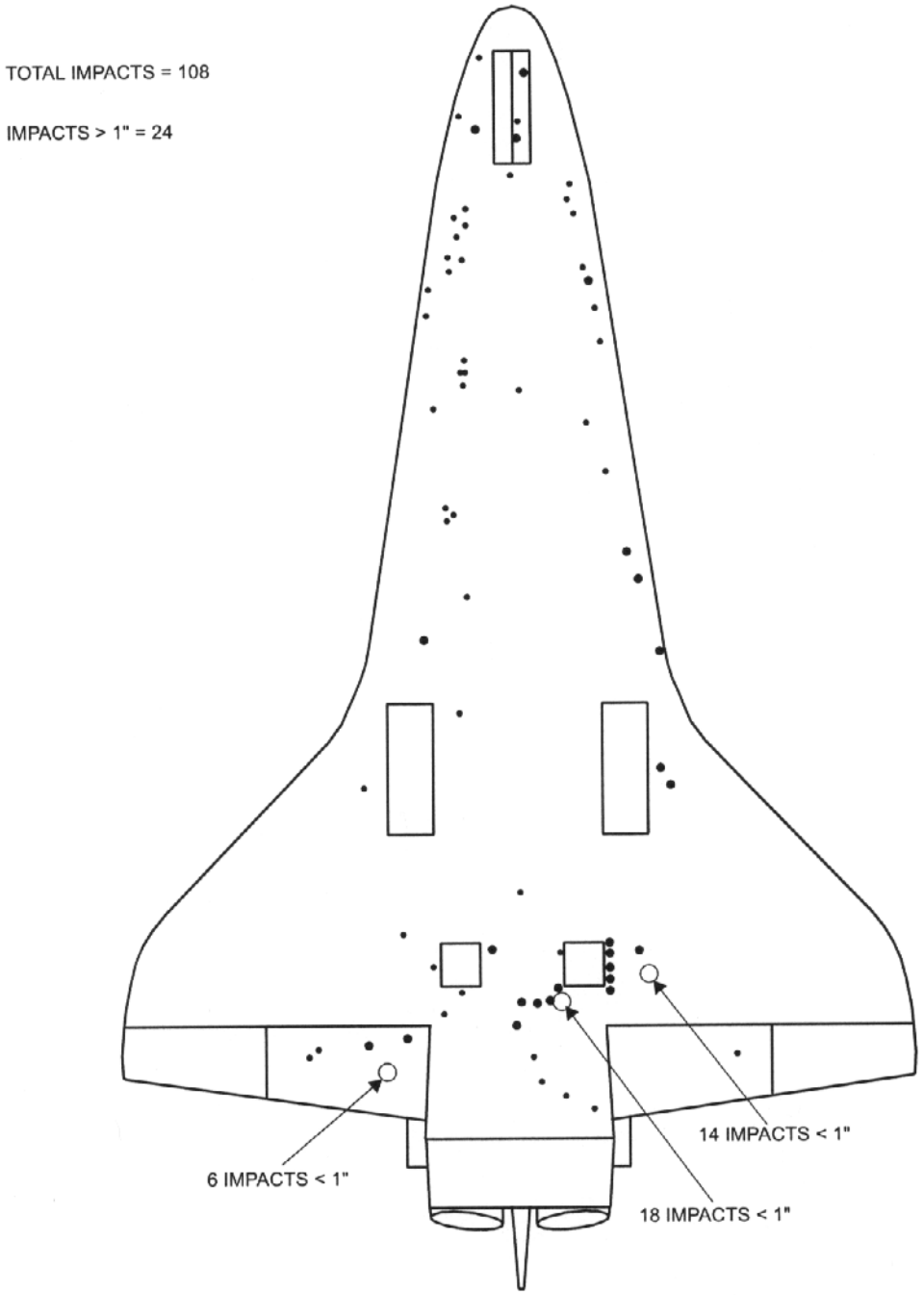


Figure 1. Lower Surface Debris Damage

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

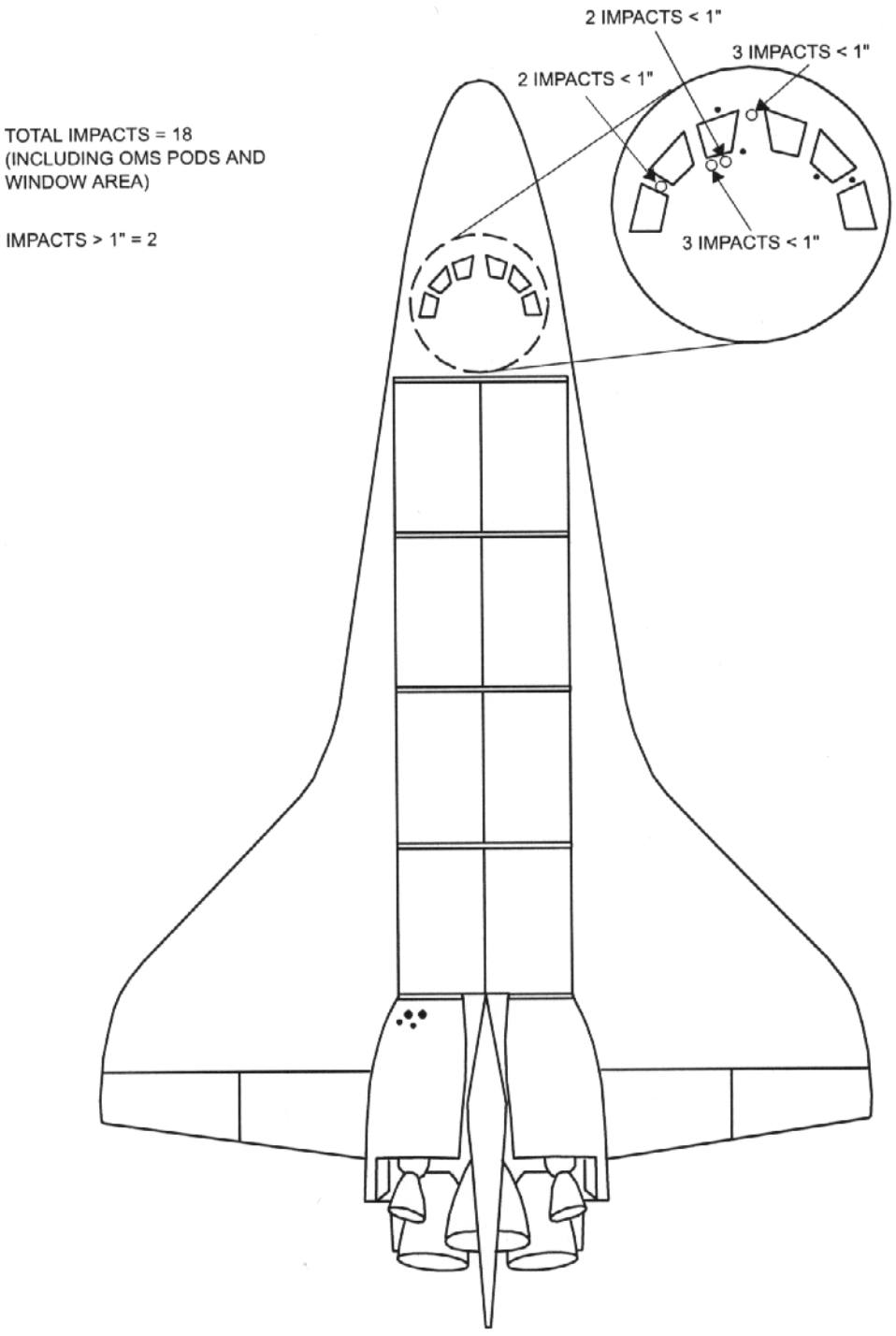
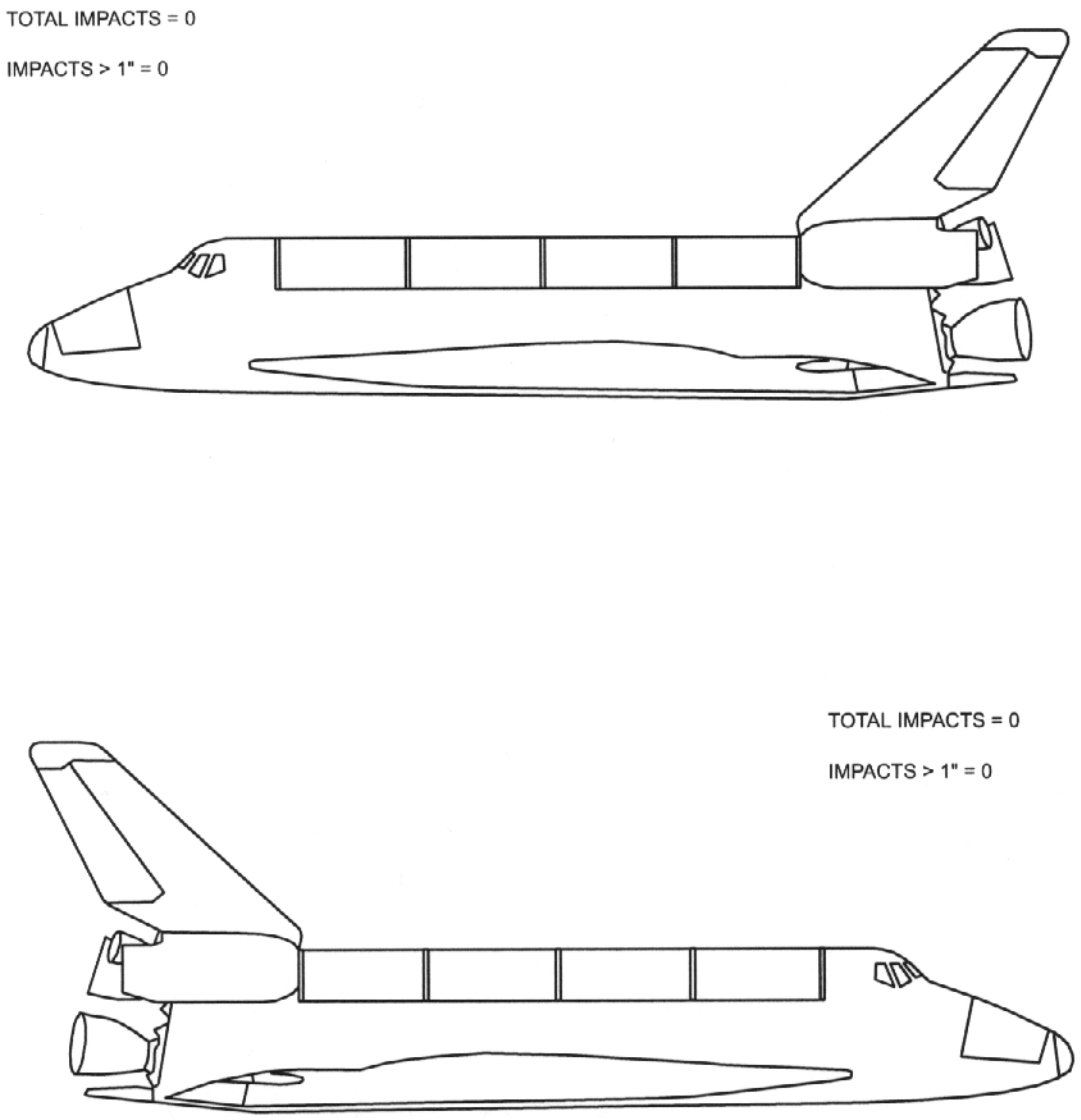


Figure 2. Upper Surface Debris Damage

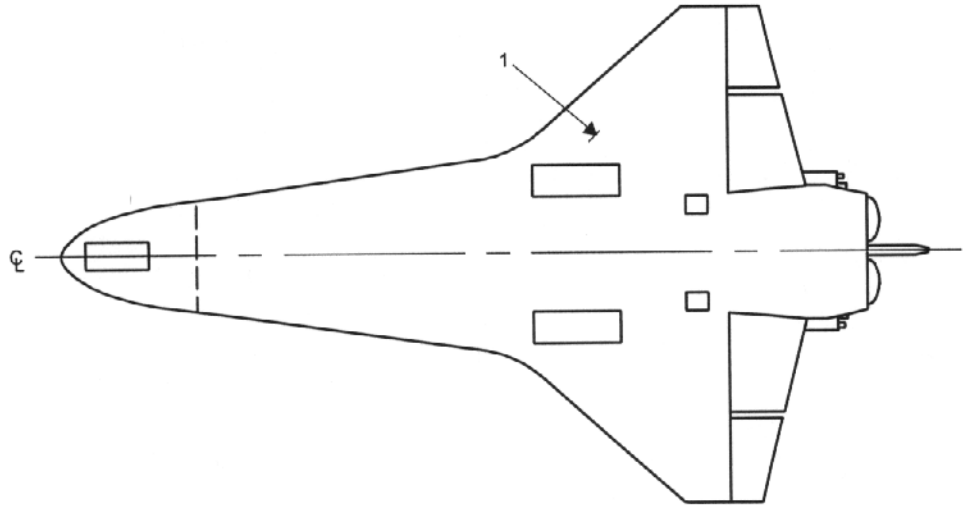
Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Figure 3. Fuselage Debris Damage

Table 6. Protruding Gap Filler Locations



LOCATION NUMBER	X	Y	ADJACENT TILE NUMBERS	AMOUNT PROTRUDED
1	1133.54	216.38	V070-191005-036 AND -069	0.200"

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 7. Summary of Reentry Data

ORBITAL INCLINATION: **51.6°**
ANGLE OF ATTACK: **40°**
CROSSRANGE, NM: **334.9**
WEIGHT AT ENTRY INTERFACE, LBS X 1000: **210.6**
CENTER OF GRAVITY AT ENTRY INTERFACE, INCH: X_O = **1082.8**
ELEVON POSITION*: **-5.0°**
BODY FLAP POSITION*: **1.0°**
*POSITION AT TIME OF PEAK HEATING DURING REENTRY. UP IS INDICATED BY (-), DOWN IS INDICATED BY (+).

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

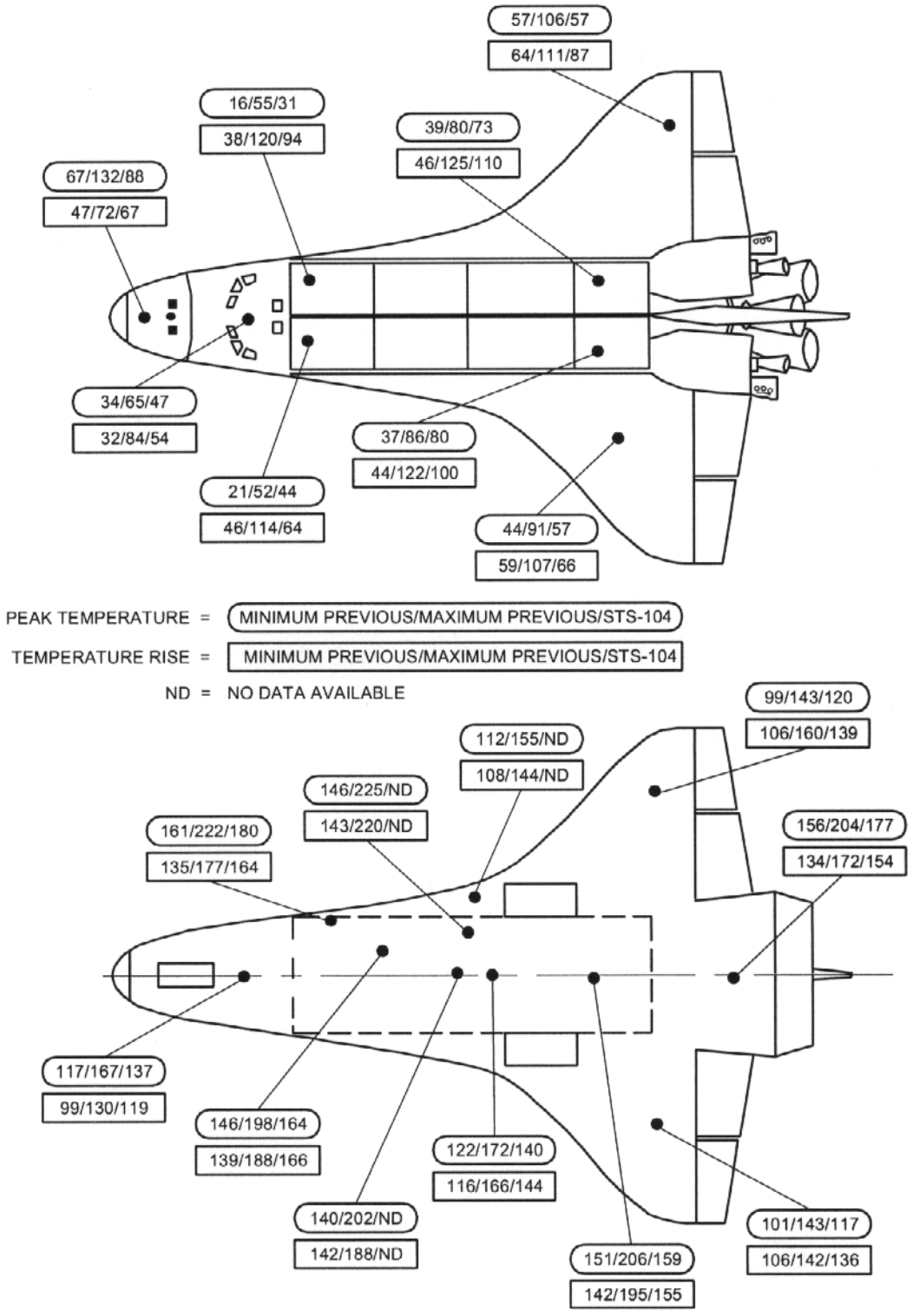
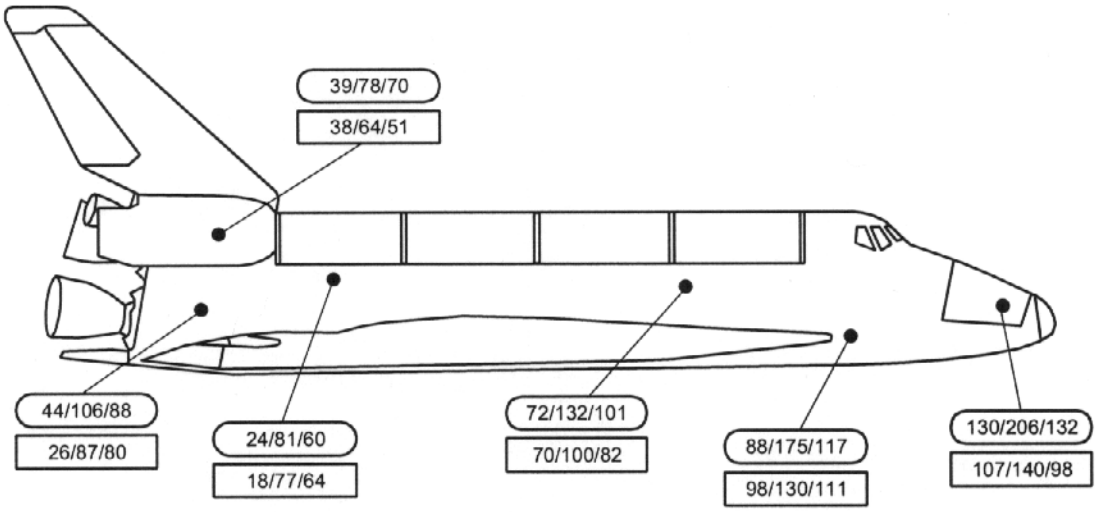


Figure 4. Peak and Structural Temperature Rises (°F)

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



PEAK TEMPERATURE = MINIMUM PREVIOUS/MAXIMUM PREVIOUS/STS-104

TEMPERATURE RISE = MINIMUM PREVIOUS/MAXIMUM PREVIOUS/STS-104

ND = NO DATA AVAILABLE

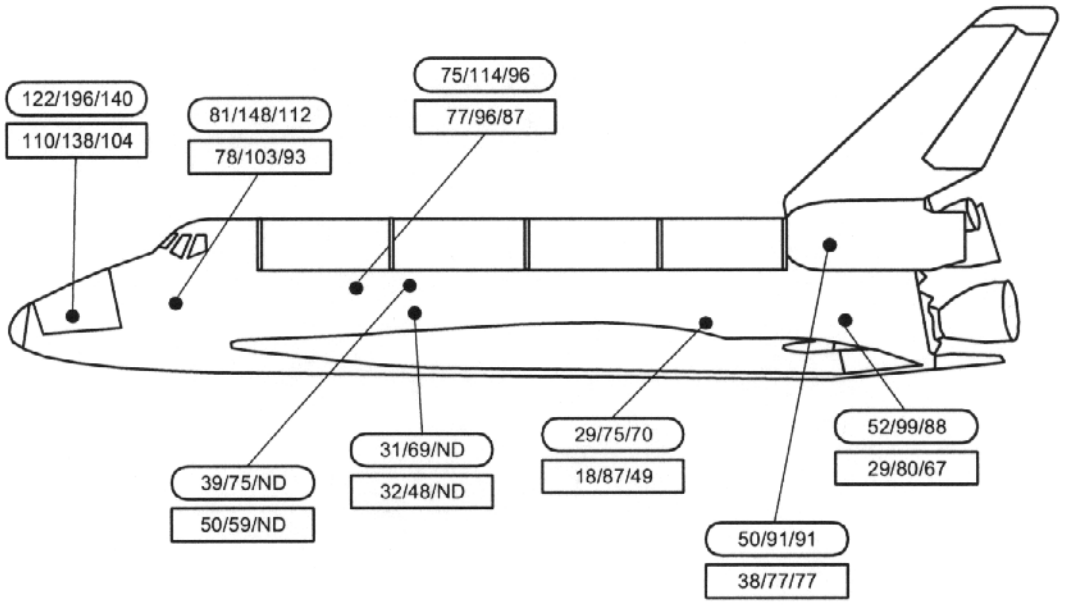
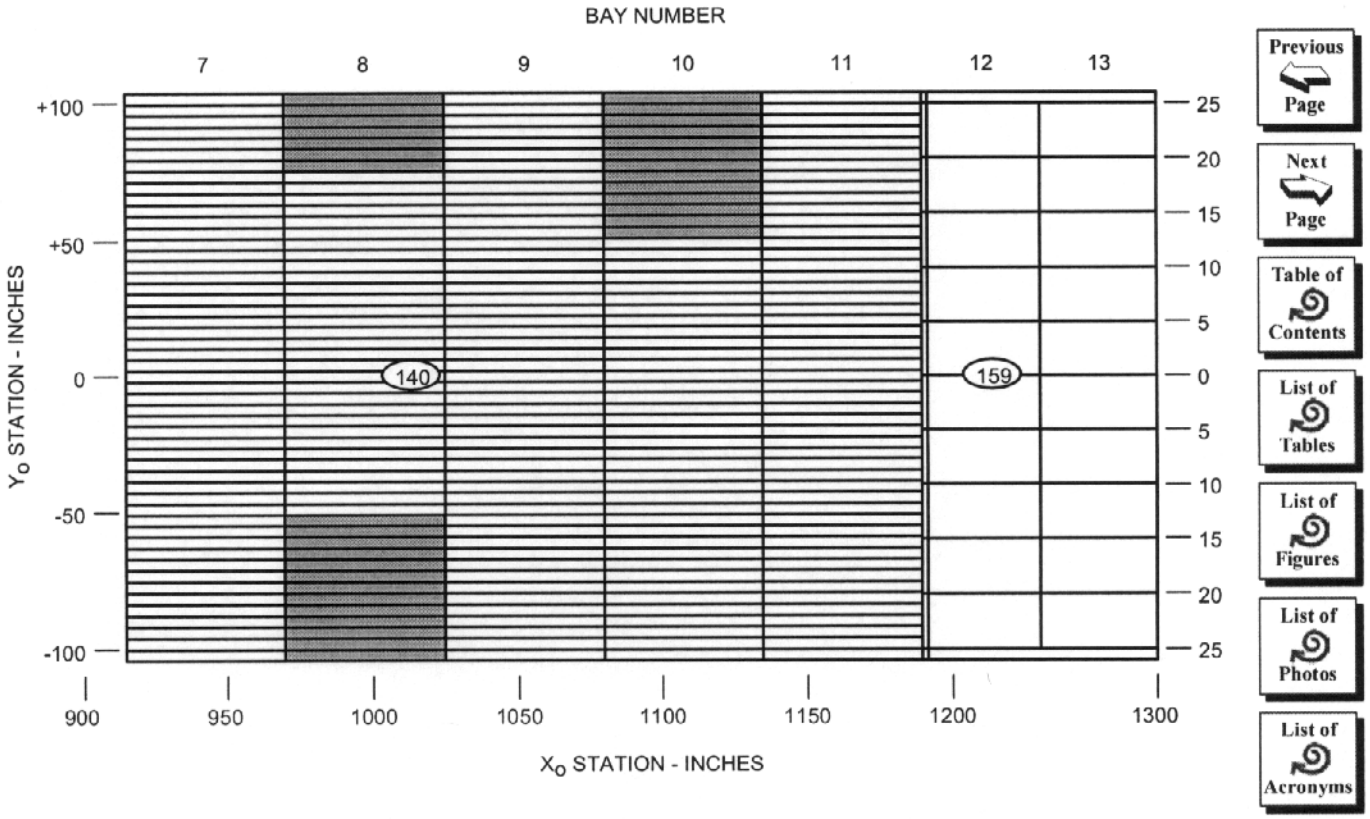


Figure 4. Peak and Structural Temperature Rises (°F) (cont'd)

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



NX = TEMPERATURE LESS THAN 130°F

N3 = TEMPERATURE LESS THAN 150°F

BLANK INDICATES TEMPILABEL® NOT READ

Figure 5. Midfuselage (with Wing Carry Through) Lower Skin Structure Tempilabel® Data

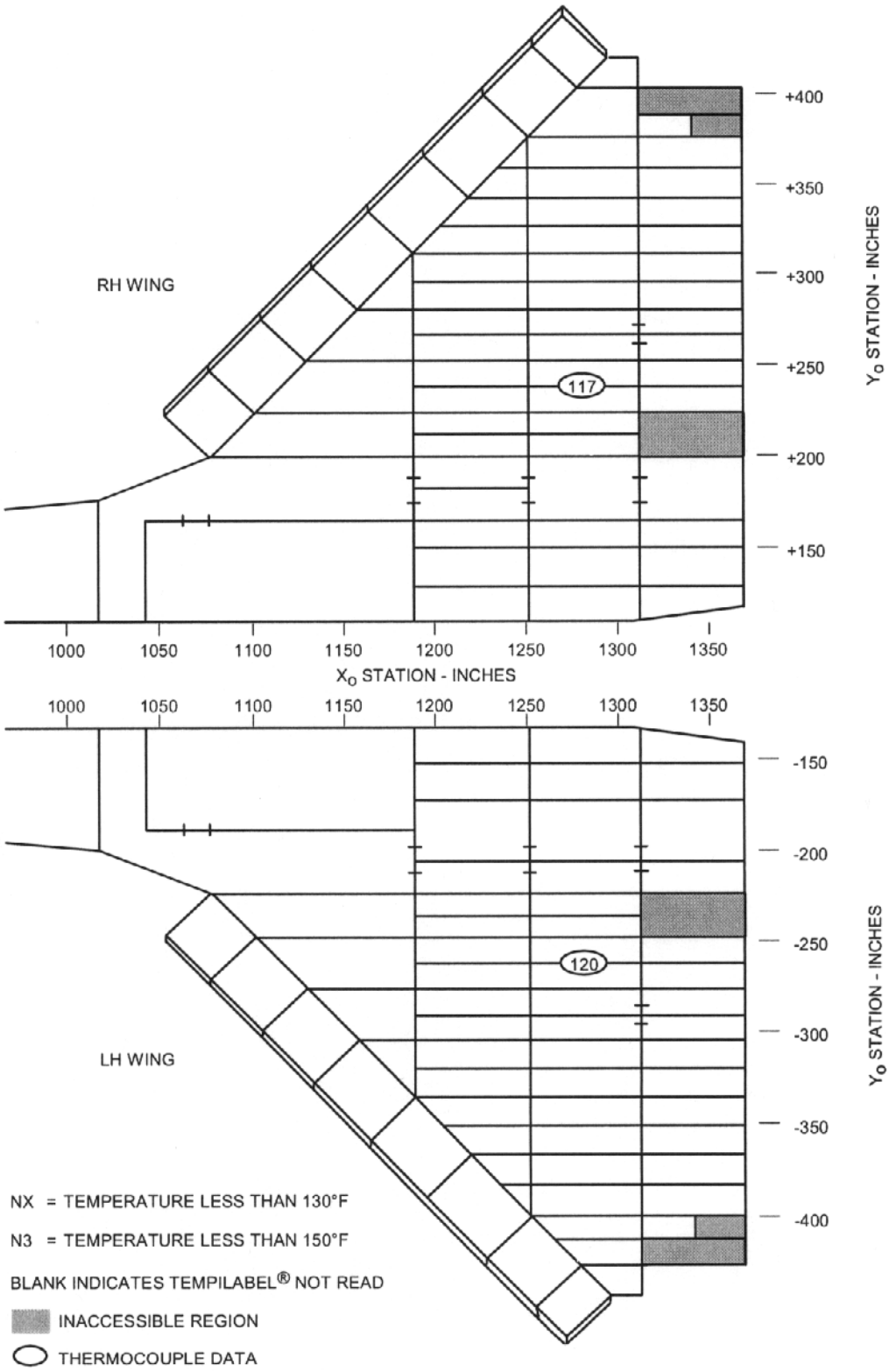


Figure 6. Lower Wing Structure Tempilabel® Data

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

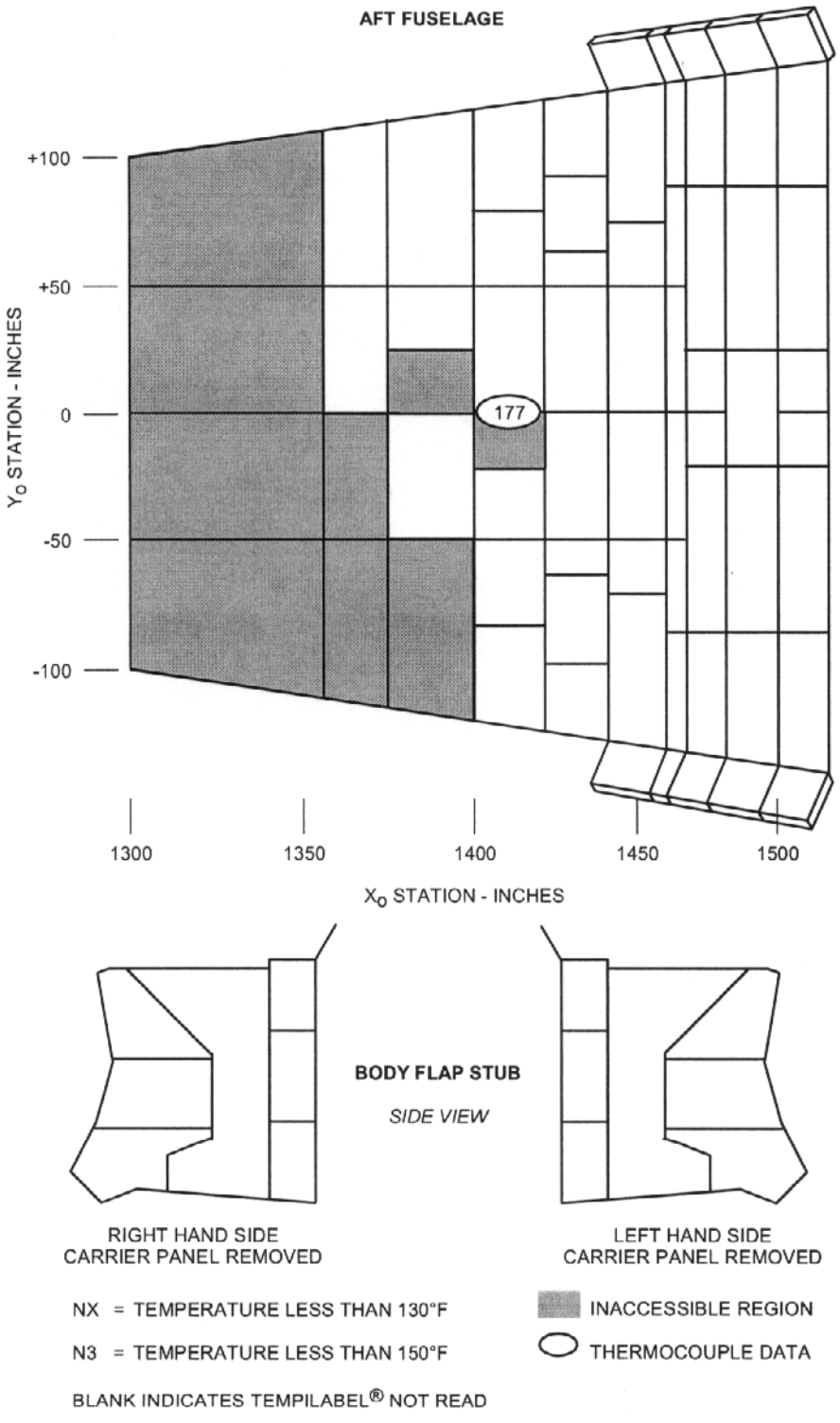


Figure 7. Aft Fuselage Lower Skin and Body Flap Stub Structure Tempilabel® Data

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

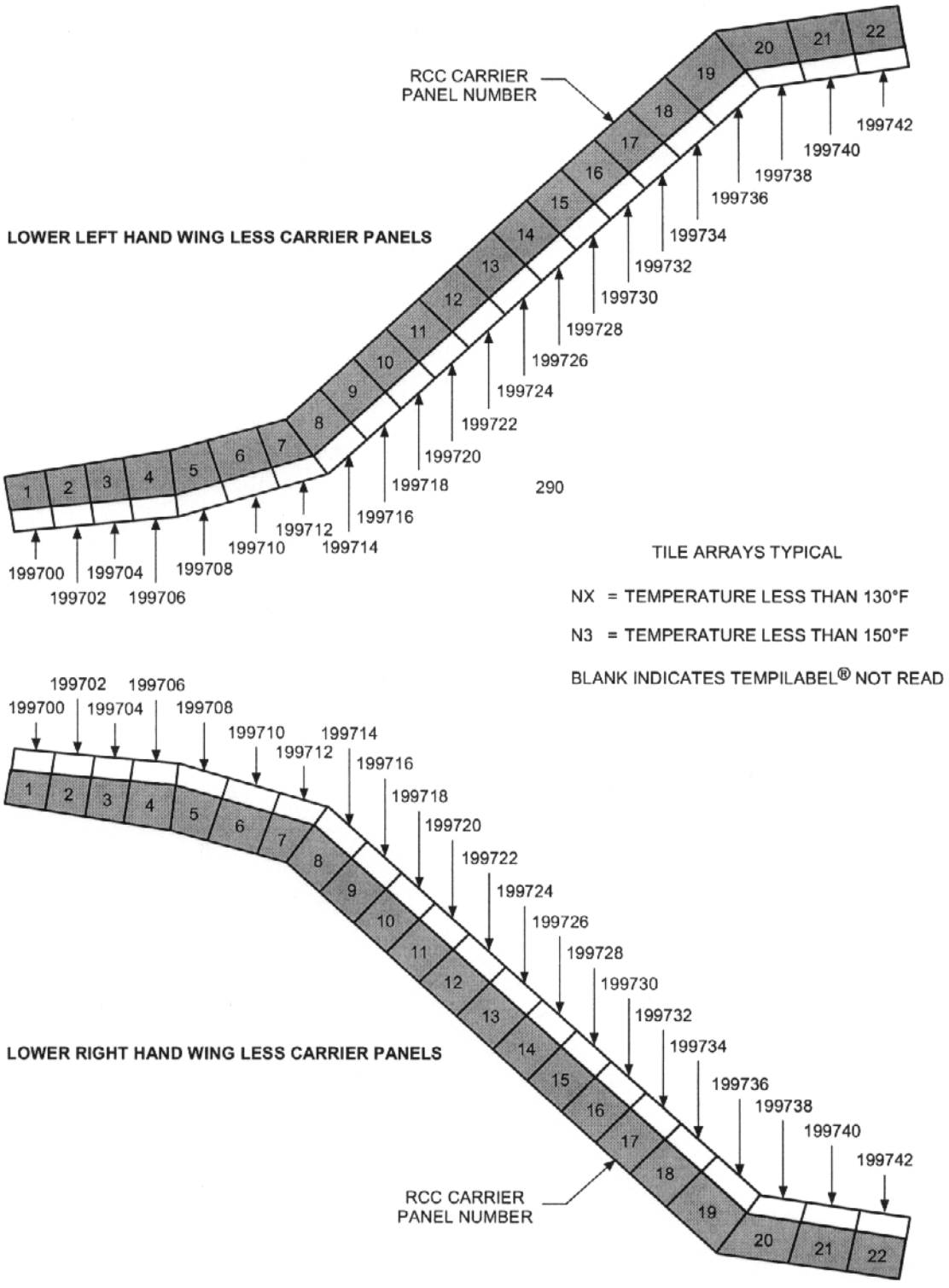


Figure 8. Lower Wing LESS Carrier Panels Tempilabel® Data

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

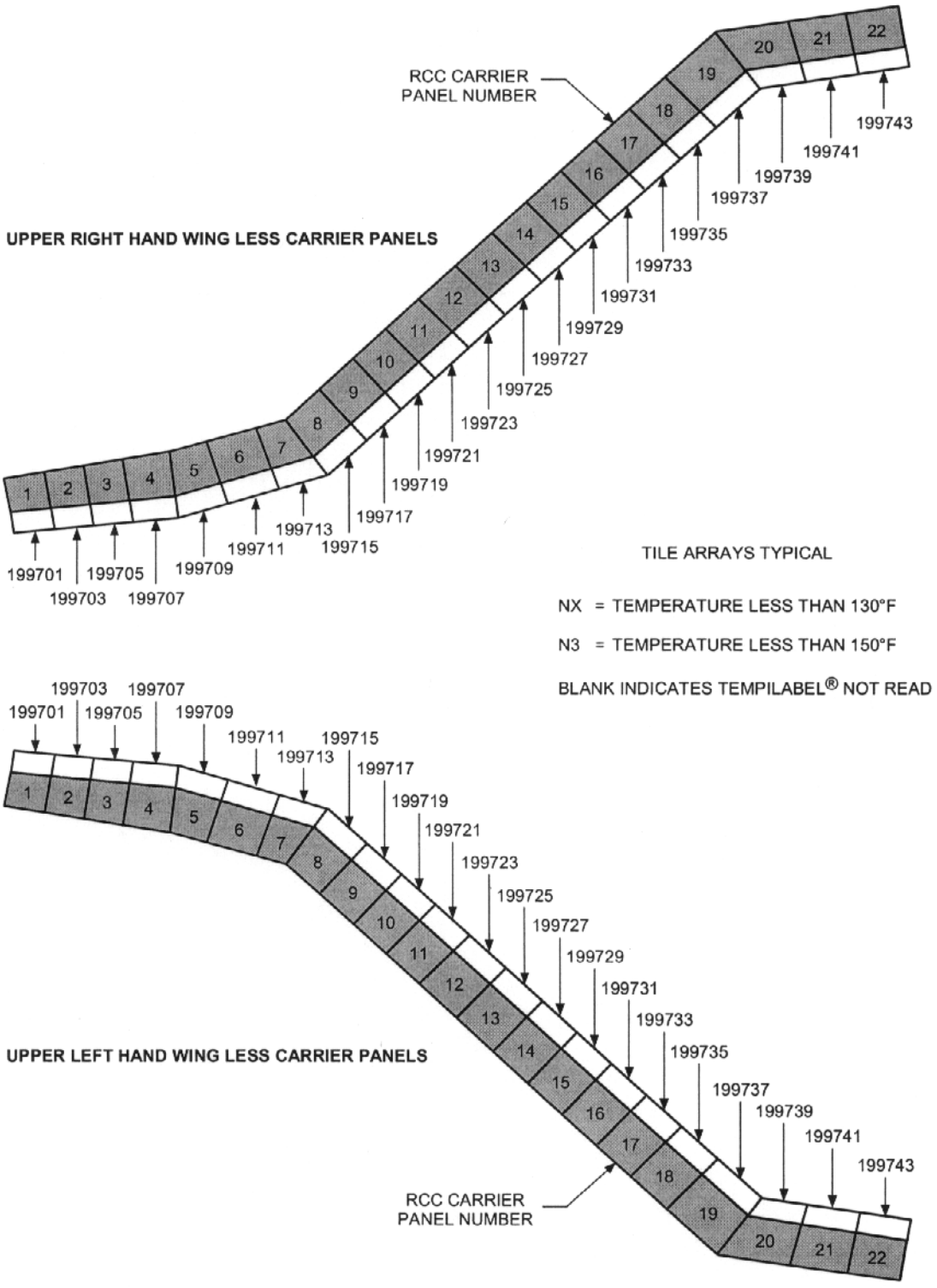
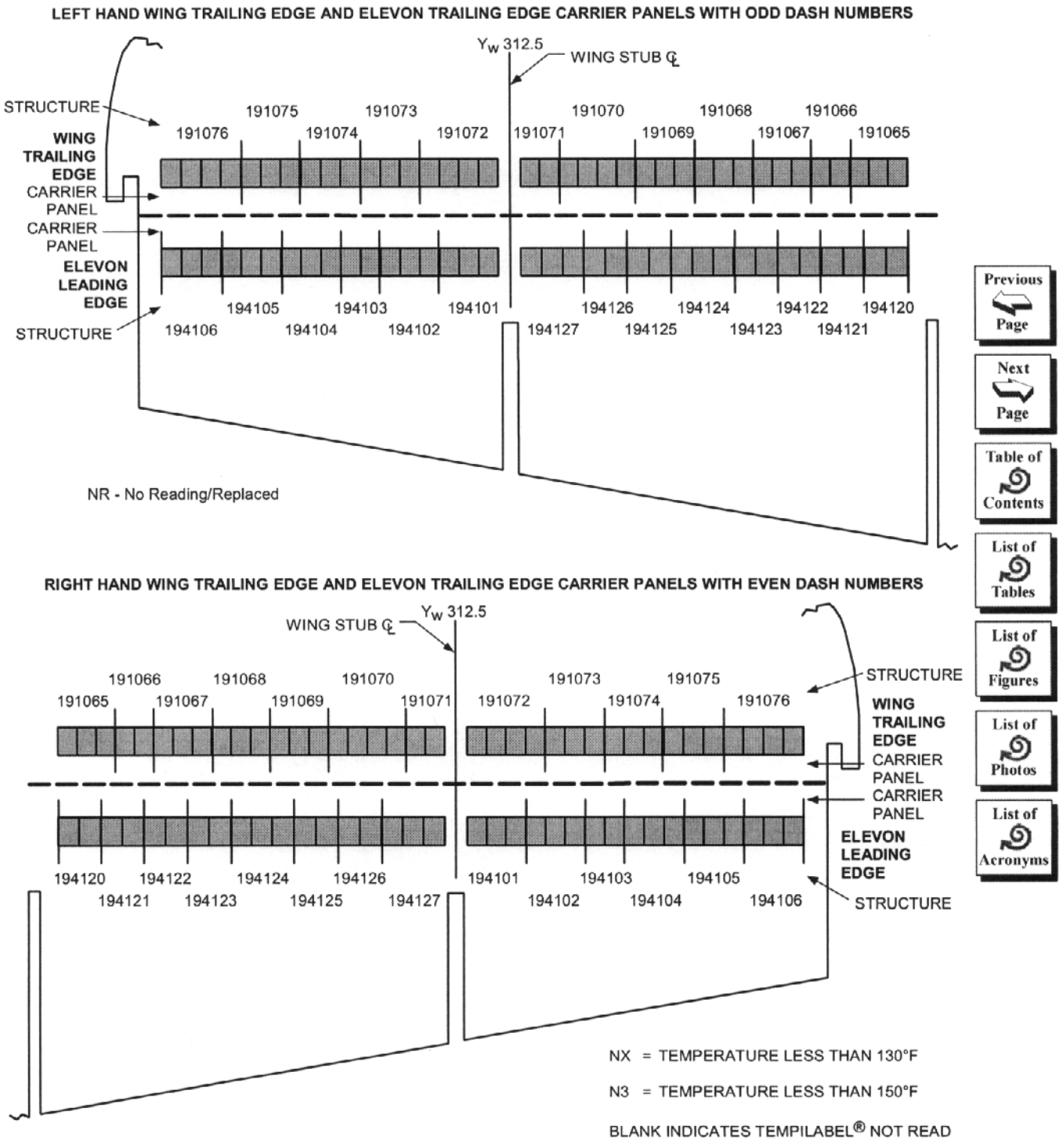


Figure 9. Upper Wing LESS Carrier Panels Tempilabel® Data

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Figure 10. Wing-Elevon Lower Cove Tempilabel® Data

Table 8. Boundary Layer Transition Flight Comparison - OV-104 Only

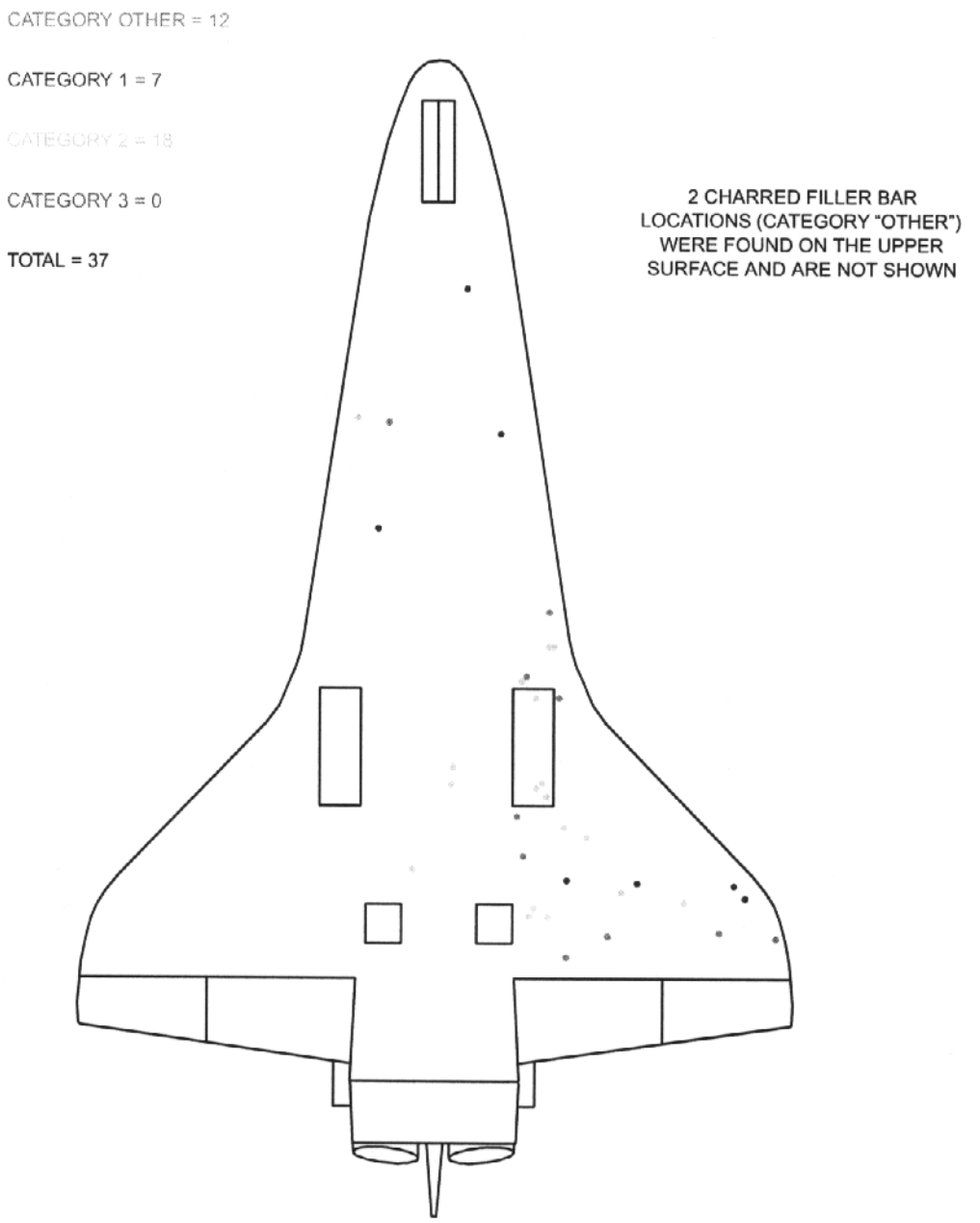
TRANSITION TIME IN SECONDS (SINCE ENTRY INTERFACE) AT THE MOST CONSISTENT FORWARD AND AFT THERMOCOUPLE LOCATIONS				
MISSION	VEHICLE	FLIGHT	FORWARD @ X/L=0.3 (V07T9468)	AFT @ X/L=0.6 (V07T9478 & EQUIVALENT)
STS-27R	OV-104	3	NO DATA	1150
STS-30R	OV-104	4	NO DATA	1210
STS-34	OV-104	5	NO DATA	1115
STS-36	OV-104	6	NO DATA	1240
STS-38	OV-104	7	NO DATA	1200
STS-37	OV-104	8	NO DATA	1210
STS-43	OV-104	9	NO DATA	1280
STS-44	OV-104	10	NO DATA	1230
STS-45	OV-104	11	NO DATA	1290
STS-46	OV-104	12	NO DATA	1250
STS-66	OV-104	13	NO DATA	1213
STS-71	OV-104	14	NO DATA	NO DATA
STS-74	OV-104	15	NO DATA	1150
STS-76	OV-104	16	NO DATA	1232
STS-79	OV-104	17	NO DATA	1303
STS-81	OV-104	18	NO DATA	1000
STS-84	OV-104	19	NO DATA	1215
STS-86	OV-104	20	NO DATA	1150
STS-101	OV-104	21	NO DATA	1130
STS-106	OV-104	22	NO DATA	1105
STS-98	OV-104	23	NO DATA	1251
STS-104	OV-104	24	NO DATA	1287
OV-104 AVERAGE			**NO DATA**	**1200.5**
FLEET AVERAGE			**1188.3**	**1173.2**

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 9. OV-104 Charred Filler Bar History

MISSION/FLT	CAT 1	CAT 2	CAT 3	OTHER	TOTAL
STS-30R/FLT 4	441	207	4	0	652
STS-34/FLT 5	225	88	1	0	314
STS-36/FLT 6	60	27	3	3	93
STS-38/FLT 7	30	24	1	0	55
STS-37/FLT 8	85	8	1	4	98
STS-43/FLT 9	123	56	9	0	188
STS-44/FLT 10	176	13	4	0	193
STS-45/FLT 11	54	24	1	0	79
STS-46/FLT 12	82	23	19	0	124
STS-66/FLT 13	51	77	0	0	128
STS-71/FLT 14	3	10	2	0	15
STS-74/FLT 15	30	27	2	0	59
STS-76/FLT 16	8	1	0	0	9
STS-79/FLT 17	7	6	1	0	14
STS-81/FLT 18	8	11	3	0	22
STS-84/FLT 19	4	6	0	0	10
STS-86/FLT 20	4	26	0	0	30
STS-101/FLT 21	21	42	0	6	69
STS-106/FLT 22	21	41	0	23	85
STS-98/FLT 23	5	6	0	0	11
STS-104/FLT 24	7	18	0	12	37
OV-104 AVERAGE	**68.8**	**35.3**	**2.4**	**2.3**	**108.8**
OV-104 MEDIAN	**30.0**	**24.0**	**1.0**	**0.0**	**69.0**
FLEET AVERAGE	**71.3**	**45.4**	**3.8**	**5.0**	**125.5**
FLEET MEDIAN	**28.0**	**26.0**	**2.0**	**0.0**	**74.5**

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Figure 11. Charred Filler Bar Locations

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.0 EVALUATION

5.1 Lower Fuselage and Wings

5.1.1 General

(X. Dominguez)

Post-landing assessment of the lower surface fuselage and wings found the overall condition of the TPS components to be nominal. The number of lower surface debris impact damages greater than 1 inch was slightly more than that of previous missions (refer to figure 1). Locations of charred filler bar conditions for the lower surface of the vehicle were significantly below the averages for the vehicle and for that of the fleet (refer to table 9). Post-landing inspections found one location where Ames gap fillers were protruding beyond the OML plane of the adjacent tile installations (refer to table 6 and photo 5 for location). The gap filler protrusion was approximately 0.200 inch for a length of approximately 2.5 inches. No local or downstream effects of the protruding condition were identified. This condition is caused by an insufficient RTV bondline at the filler bar interface that yields under flight conditions and the gap filler begins to migrate out of the gap during flight. Protruding Ames often have a portion of the gap filler still bonded, which keeps the gap filler from migrating completely out of the gap. The protrusions of gap fillers are considered a contributor to conditions that cause early/asymmetric transitions.

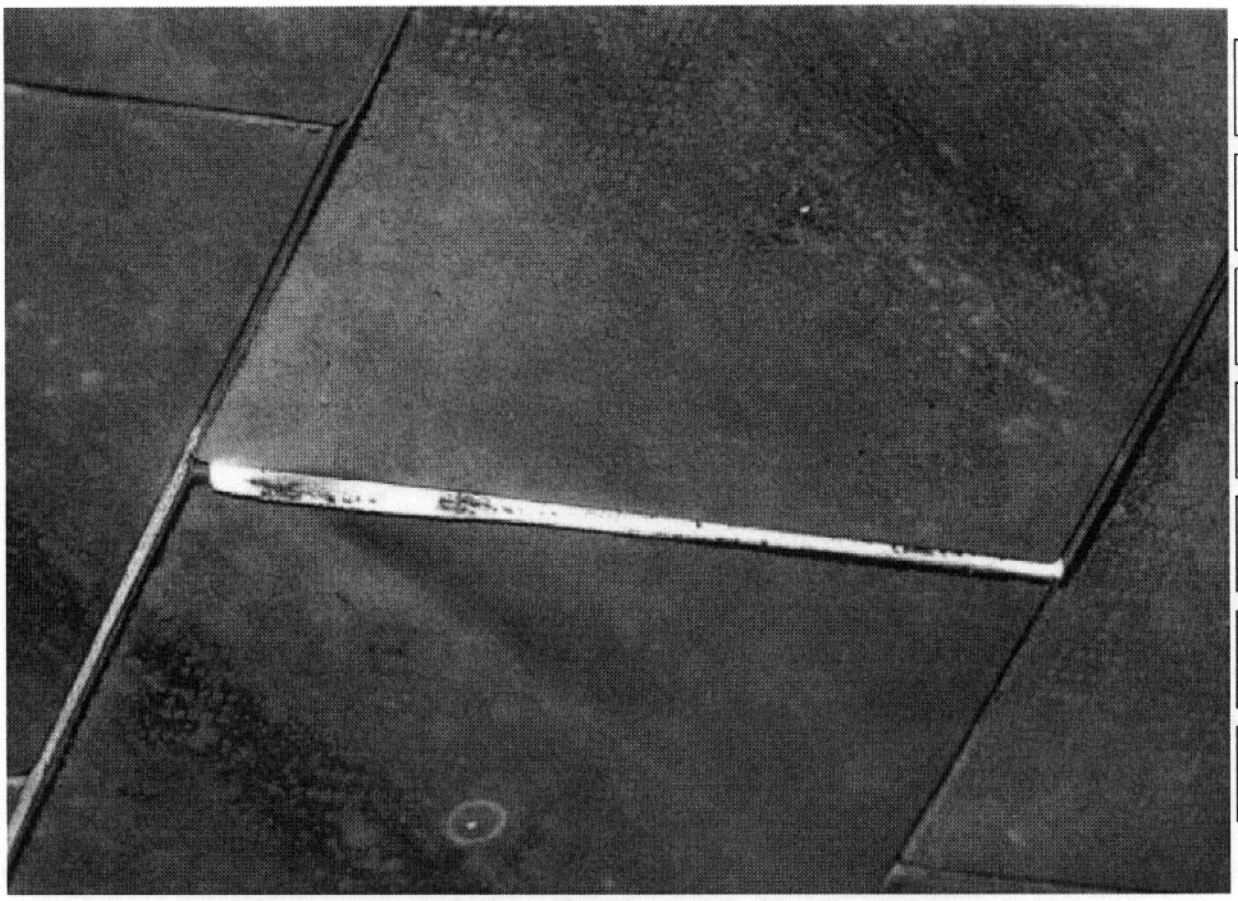
Two Ames gap fillers were found under the nose landing gear door (refer to photo 6). It is suspected that the Ames were installed to rework voids/flowpath locations along the NLGD at the interface to the thermal barriers. The bondline of this type of Ames rework is typically 1 inch in depth. Reentry heating degrades the bondline for this type of Ames rework such that when the NLGDs open some of the Ames fall off. Any remaining Ames still bonded to tile sidewalls are usually loose and if touched may fall off. This is not a concern post flight because turnaround processing and OMRSD requirements dictate removal of any remaining Ames post landing. Processing operations prior to flight reevaluate the interface between tiles and thermal barriers around the NLGD and rework poor compression/flowpath locations with new Ames installations, if required, to obtain a good seal.

A discoloration that appeared to be a deposit on the OML of the V070-199714-068 tile was observed on the runway post landing. A closer evaluation by engineering revealed a tape deposit on the OML (refer to photo 7). Various other tile damages such as the V070-191003-244 tile (refer to photo 8) on the lower fuselage and wings were repaired utilizing established standard procedures.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

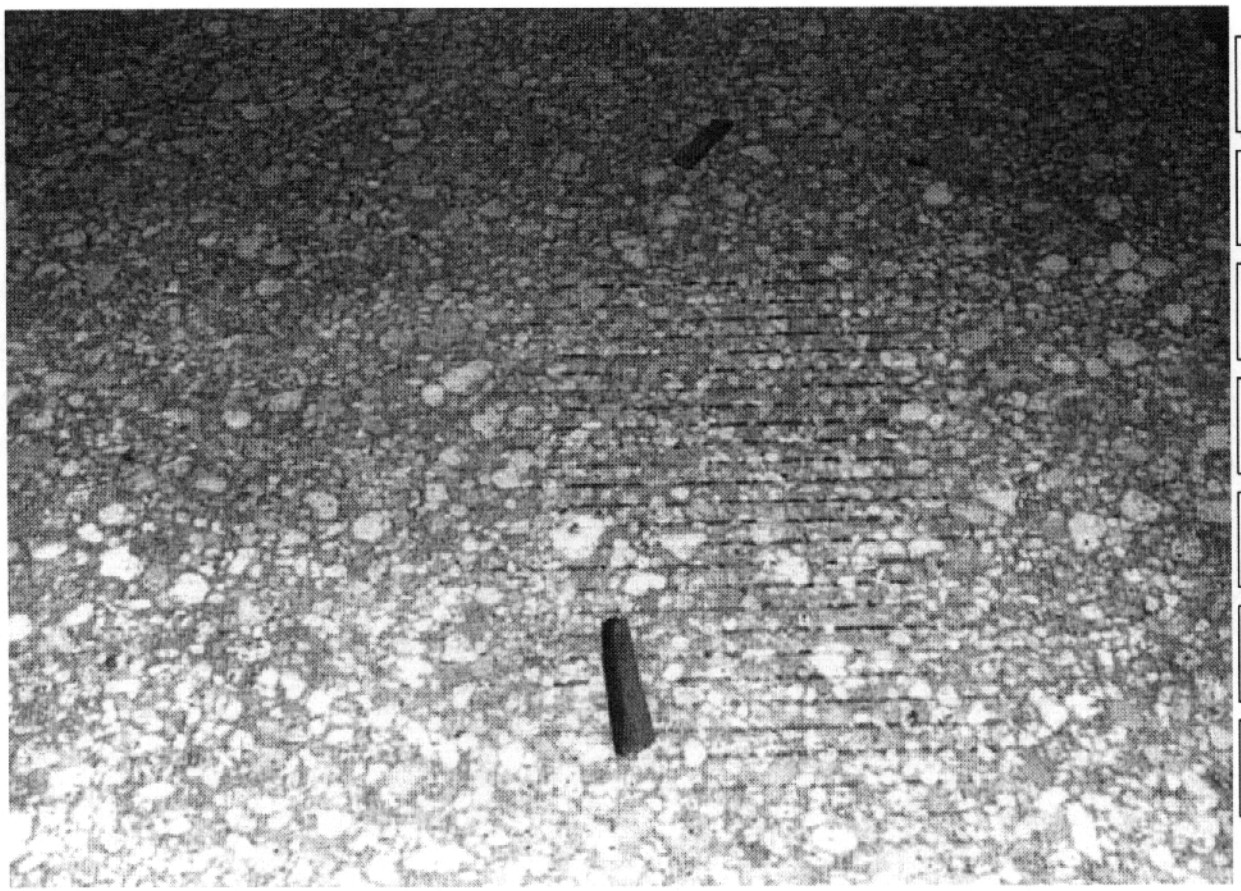


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 5. Left Hand Wing Protruding Ames Gap Filler (V070-191005-036/-069)

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 6. Two Ames Gap Fillers Found on Runway Underneath the NLGD

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

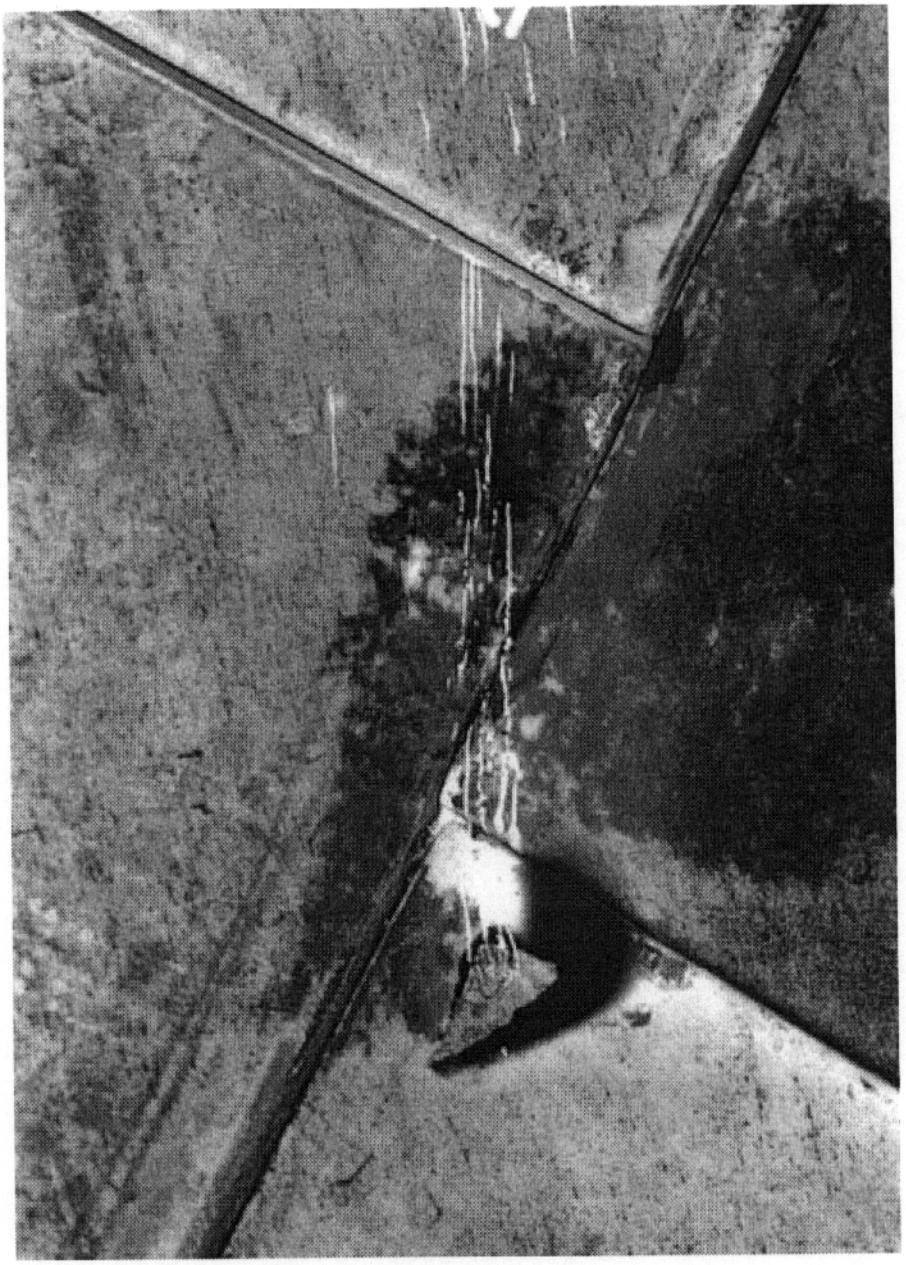
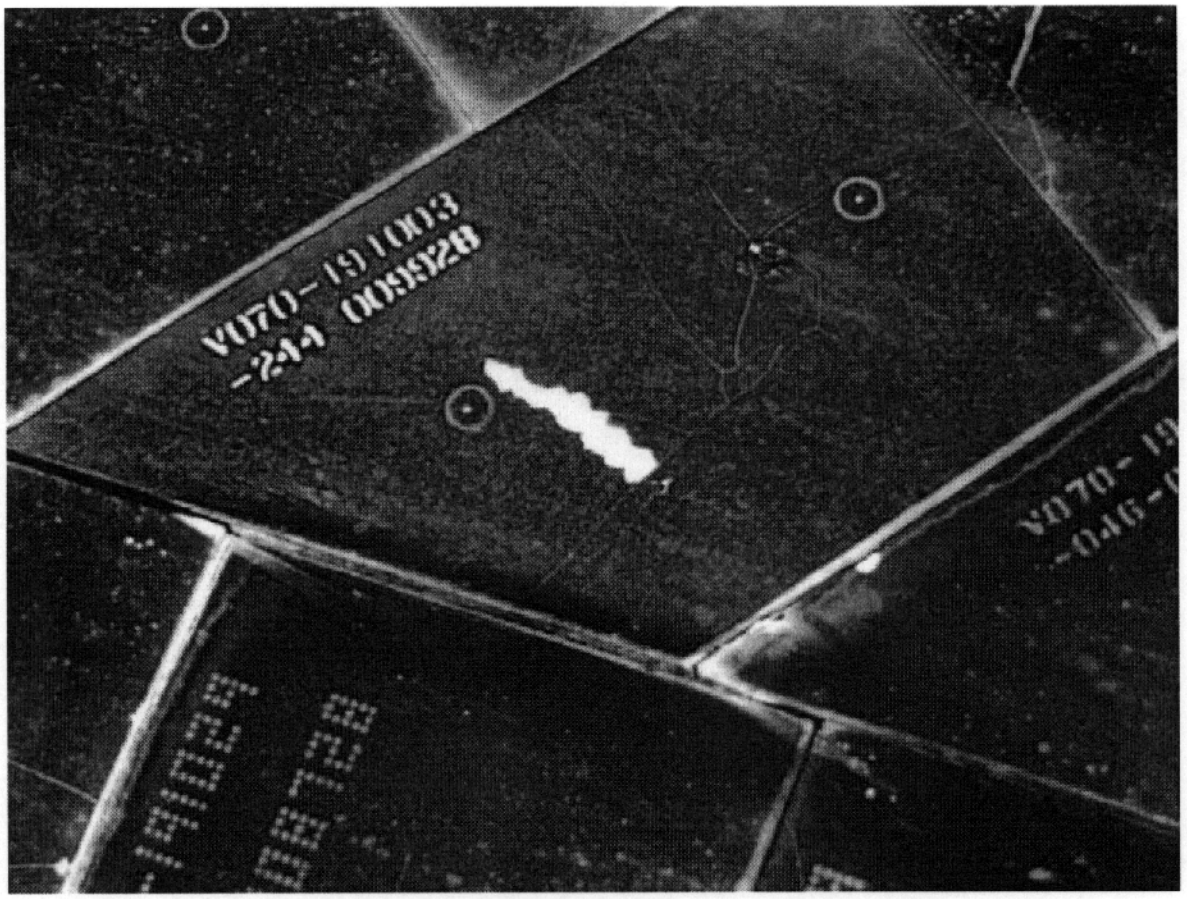


Photo 7. Tape Residue on Lower Right Hand LESS Carrier Panel Number 8 Tile (V070-199714-068)

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 8. V070-191003-244 Tile OML Damage

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.1.2 Nose Landing Gear Door Area

(X. Dominguez)

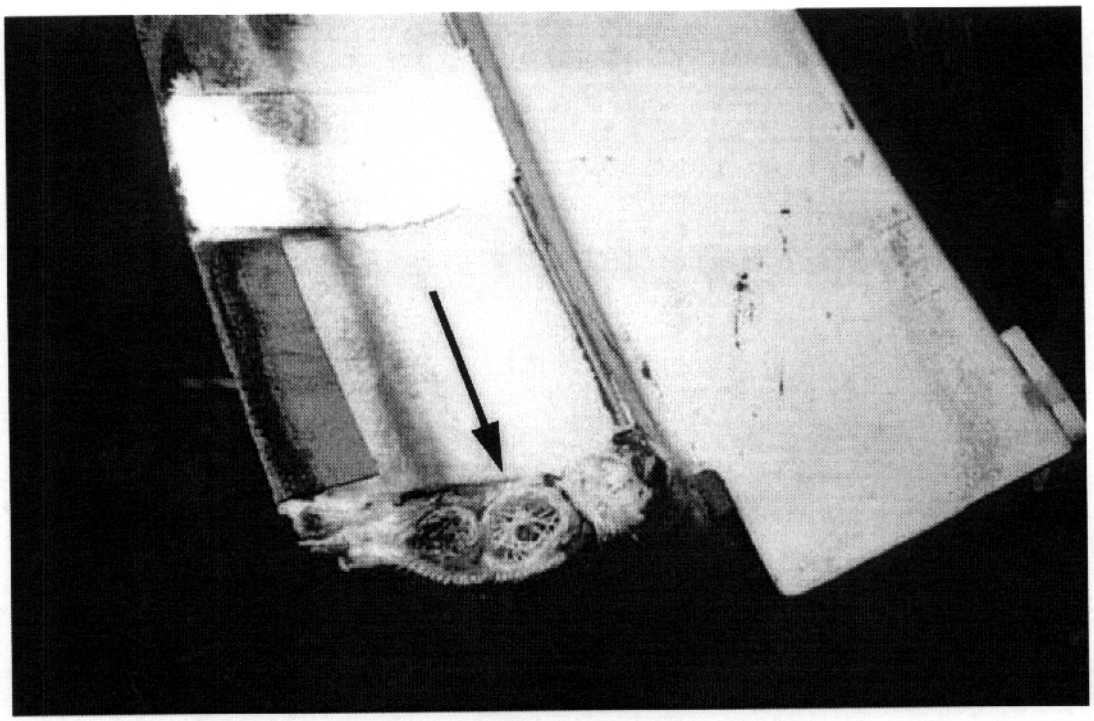
The assessment of the NLGD area post landing again revealed that the V070-398374-001 centerline primary thermal barrier had the inner filler batting either compressed or missing from the forward end of the barrier (refer to photo 9). As noted in previous reports, this is a condition that has been observed on other post-landing assessments of this and other vehicles. The contributors to this condition are the method of close-out for the end of the thermal barrier, and the direct impingement of turbulent 200+ mph airflow to the forward end of this thermal barrier. The end of the thermal barrier is closed out by performing a wagon wheel stitch at the end of the part for each spring tube, which ultimately allows the filler batting to be visible around/through the stitching. This configuration at the forward end of the thermal barrier, when entering the airflow during final approach landing speeds of the vehicle immediately upon opening of the doors, yields the noted condition. This repetitive condition, which requires the barrier to be removed and replaced, prompted a review of the design for a possible change. Boeing LSS engineering and TPSF personnel worked together to build two prototype parts to demonstrate two different ways to close out the end of the V070-398374-001 thermal barrier to help mitigate/eliminate the direct airflow impingement on the internal batting at the forward edge of this barrier from occurring. The prototype parts yielded successful fabrication results, and a briefing was presented at the TPS PRT in September 2001 by Boeing LSS to recommend a design change that utilized a fabric end cap covering for the noted thermal barrier. The recommended design change was approved and engineering was released in December 2001. Post landing of mission STS-104 (flight 24), the thermal barrier was removed for compressed/missing batting, and the redesigned thermal barrier with the fabric end cap cover was installed per the new drawing configuration during the processing flow for flight 25 of OV-104 (mission STS-110). Flight 25 of OV-104 will be the first vehicle/mission to fly the new configuration.

Evaluation of the chin panel area and the V070-399441-044 chin panel gap filler during runway inspection found the gap filler to be in nominal condition. The V070-391025-035 NLGD door tile was removed and replaced due to large impact damage (photo 10 and photo 11). All other TPS components in the NLGD area appeared nominal (refer to table 10 for thermal barrier replacement history).

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

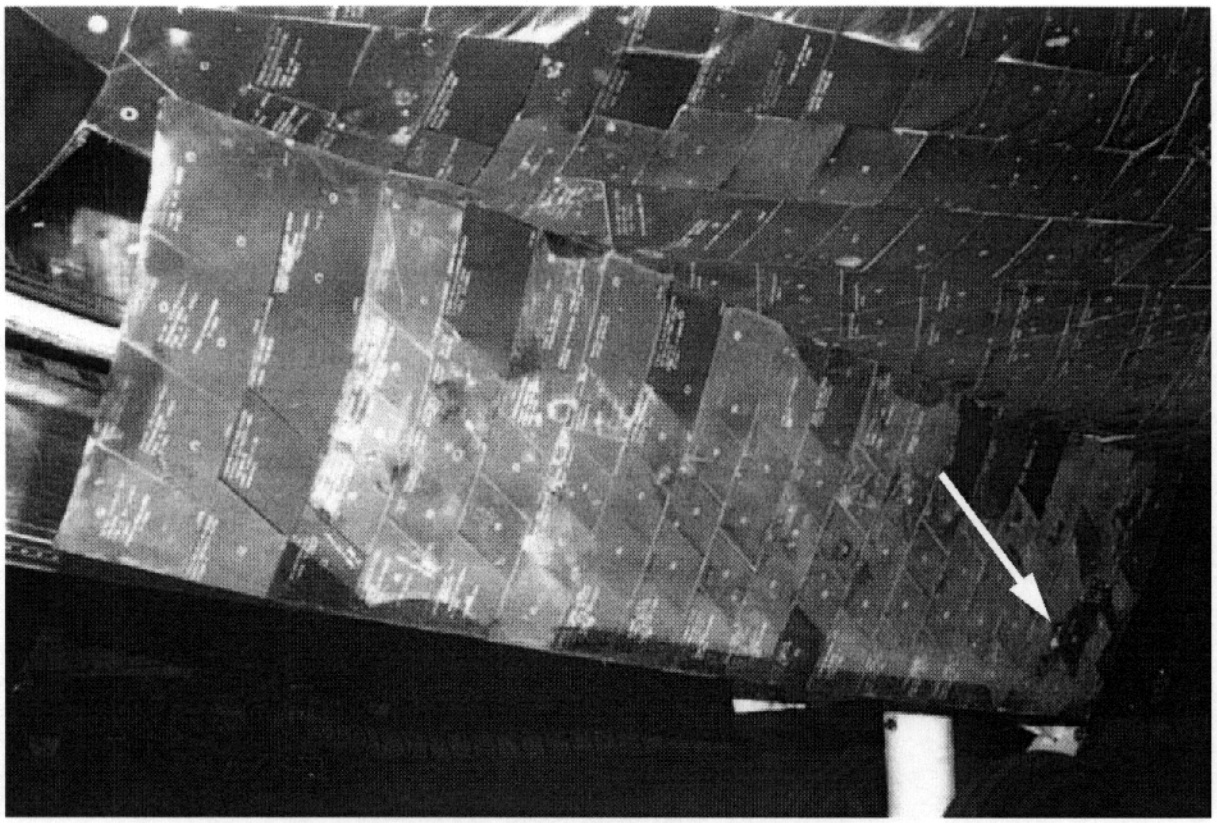


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 9. NLGD Forward Centerline Thermal Barrier (V070-398374-001)

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 10. Damaged OML Tile (V070-391025-035), Overall View

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

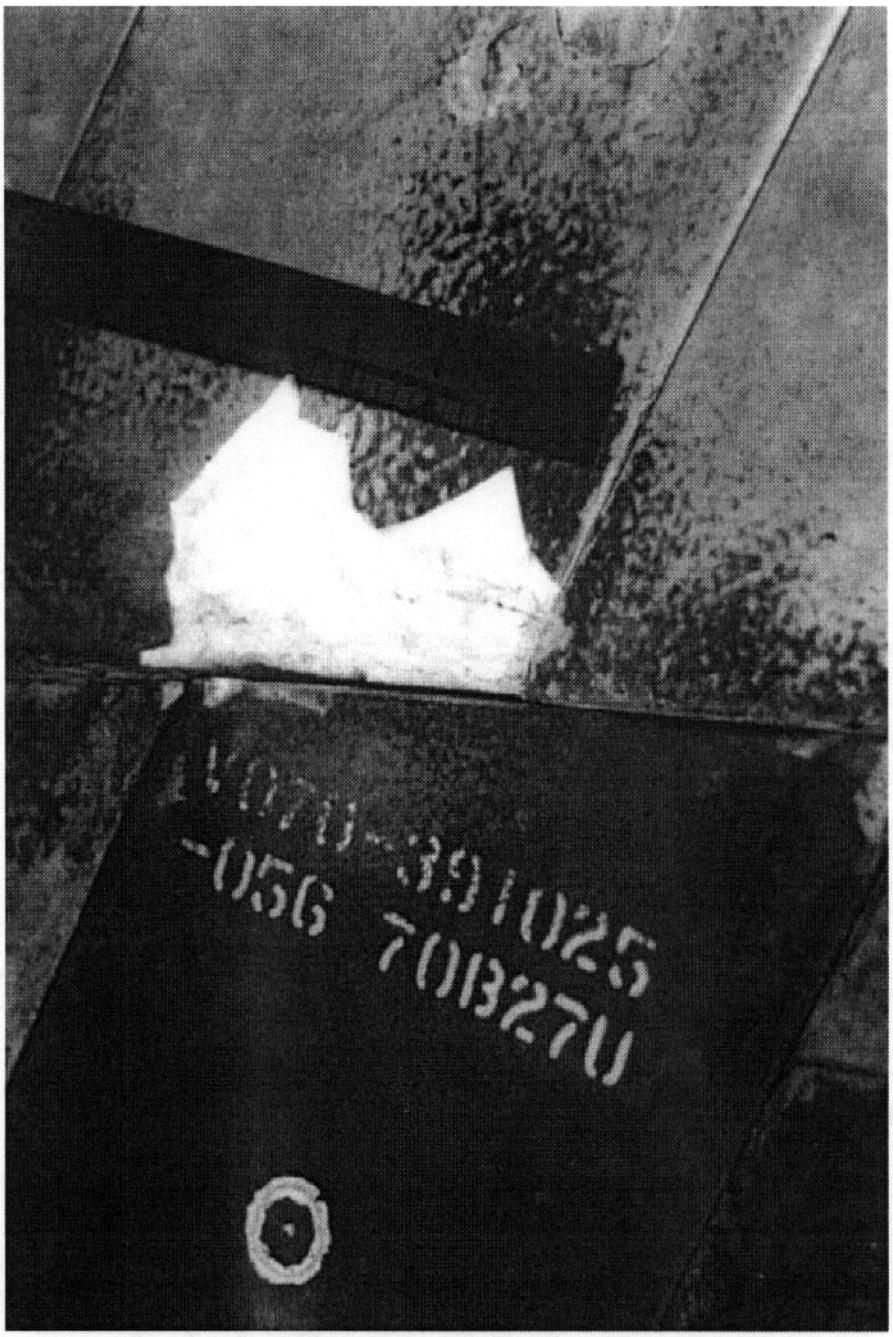


Photo 11. Damaged NLGD OML Tile (V070-391025-035)

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 10. OV-104 NLGD Thermal Barrier Replacement History

BARRIER	POST-FLIGHT NUMBER									
	20	21	22	23	24	25	26	27	28	29
C1 - OML	P	NR	D	P	D					
C1 - PRIMARY	P	NR	D	P	D					
C1 - SECONDARY	P	NR	NR	P	NR					
C2 - OML	A	NR	D	NR	D					
C2 - PRIMARY	A	NR	NR	NR	D					
C2 - SECONDARY	A	NR	NR	NR	D					
C3 - PRIMARY	A	NR	NR	NR	NR					
C4 - OML	A	NR	NR	NR	NR					
C4 - PRIMARY	A	NR	NR	NR	NR					
C5 - OML	D	NR	NR	NR	NR					
R1 - OML	P	NR	D	P	D					
R1 - PRIMARY	P	NR	D	P	D					
R1 - SECONDARY	P	NR	NR	P	NR					
R2 - OML	P	NR	NR	NR	D					
R2 - PRIMARY	P	NR	NR	NR	D					
R2 - SECONDARY	P	NR	D	NR	D					
R3 - OML	D	NR	NR	D	NR					
R3 - PRIMARY	NR	NR	NR	D	NR					
R3 - SECONDARY	NR	NR	D	D	NR					
R4 - OML	D	NR	NR	D	NR					
R4 - PRIMARY	NR	D	NR	D	NR					
R4 - SECONDARY	NR	NR	NR	D	NR					
R5 - OML	NR	D	NR	NR	D					
R5 - PRIMARY	NR	D	NR	NR	NR					
R6 - OML	NR	D	D	NR	NR					
R6 - PRIMARY	NR	D	D	NR	NR					
L1-OML	P	NR	D	P	D					

A - ACCESS TO ADJACENT COMPONENTS
B - DEBOND
D - DAMAGE
G - DEGRADED
P - CHIN PANEL SUPPORT
NR - NO REPLACEMENTS TOOK PLACE

NOTE:
REFER TO FIGURE 12 FOR NLGD THERMAL BARRIER LOCATION REFERENCES.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 10. OV-104 NLGD Thermal Barrier Replacement History (cont'd)

BARRIER	POST-FLIGHT NUMBER									
	20	21	22	23	24	25	26	27	28	29
L1 - PRIMARY	P	NR	D	P	D					
L1 - SECONDARY	P	NR	NR	P	NR					
L2 - OML	P	NR	NR	NR	NR					
L2 - PRIMARY	P	NR	NR	NR	NR					
L2 - SECONDARY	P	NR	D	NR	NR					
L3 - OML	D	NR	NR	NR	NR					
L3 - PRIMARY	A	NR	NR	NR	NR					
L3 - SECONDARY	D	NR	D	NR	NR					
L4 - OML	NR	NR	NR	NR	NR					
L4 - PRIMARY	NR	D	NR	NR	NR					
L4 - SECONDARY	NR	NR	NR	NR	NR					
L5 - OML	NR	D	NR	NR	NR					
L5 - PRIMARY	NR	D	NR	NR	NR					
L6 - OML	NR	D	NR	NR	D					
L6 - PRIMARY	NR	D	NR	NR	D					

A - ACCESS TO ADJACENT COMPONENTS
B - DEBOND
D - DAMAGE
G - DEGRADED
P - CHIN PANEL SUPPORT
NR - NO REPLACEMENTS TOOK PLACE

NOTE:
REFER TO FIGURE 12 FOR NLGD THERMAL BARRIER LOCATION REFERENCES.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

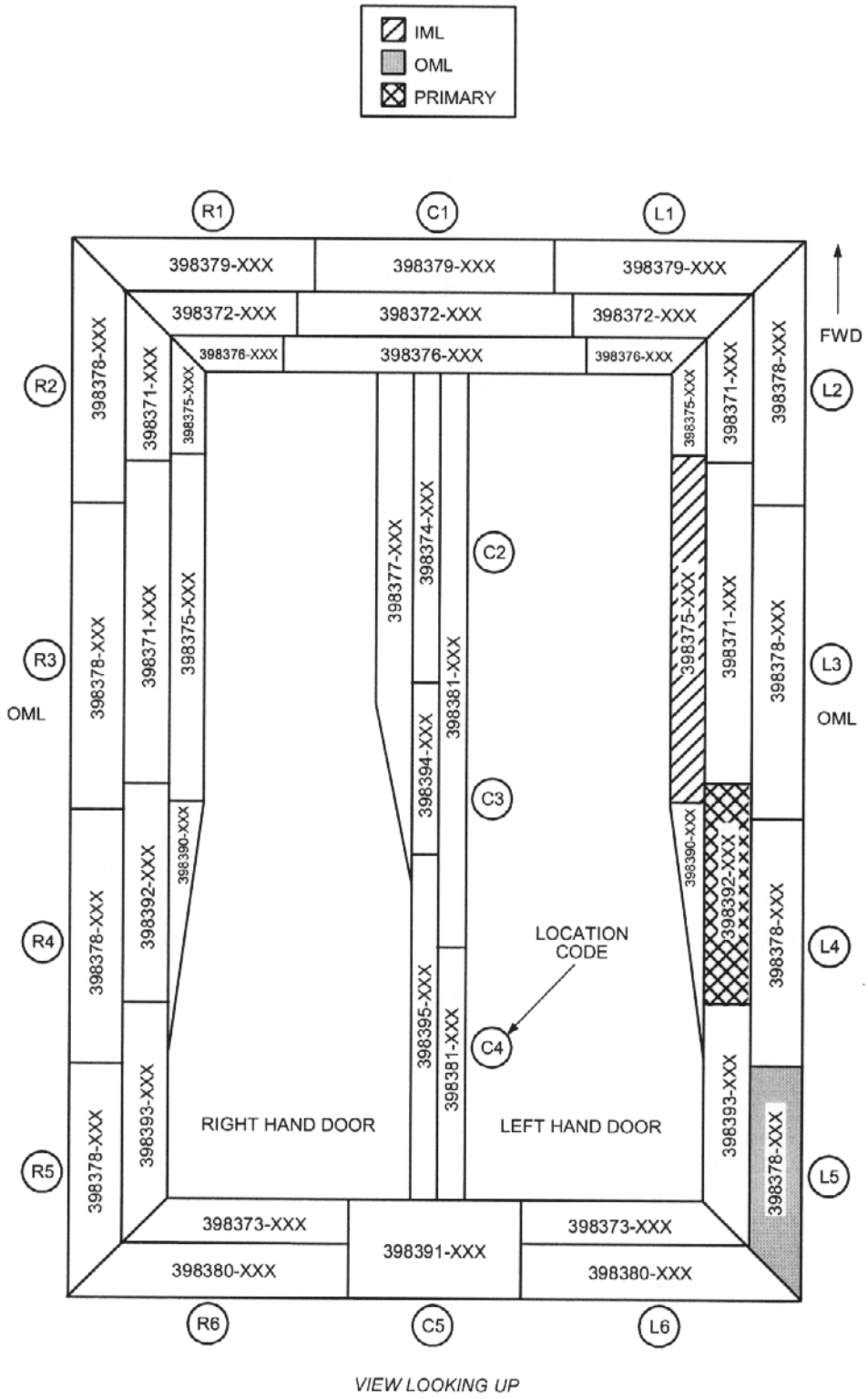


Figure 12. Nose Landing Gear Door Thermal Barrier Location References

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.1.3 Main Landing Gear Door Area

(X. Dominguez)

The performance of the TPS in the MLGD area appeared nominal. All of the periphery tiles were intact with the exception of the V070-191121-024 tile which incurred a large damage along the tile edge approximately 3.5 inches in length (refer to photo 12 and photo 13). The tile, located at the forward outboard corner on the right hand MLGD on the structure side, was removed and replaced as a result of the tile damage. Numerous MLGD periphery thermal barriers exhibited typical wear. Breaching/tearing of the outer cover fabric (refer to photo 14) occurred on 13 barriers (8 on the right side and 5 on the left side) which required removal and replacement with new parts. Refer to table 11 below for thermal barrier replacement history.

Table 11. OV-104 MLGD Thermal Barrier Replacement History

BARRIER	POST-FLIGHT NUMBER									
	20	21	22	23	24	25	26	27	28	29
L1	D	NR	NR	D	NR					
L2	NR	NR	NR	D	NR					
L3	NR	D	NR	NR	D					
L4	NR	NR	NR	D	NR					
L5	NR	NR	NR	D	NR					
L6	NR	NR	NR	NR	NR					
L7	NR	NR	NR	NR	NR					
L8	NR	D	NR	NR	NR					
L9	NR	NR	NR	D	NR					
L10	NR	NR	NR	NR	NR					
L11	NR	NR	NR	NR	D					
L12	NR	NR	D	NR	D					
L13	D	NR	NR	NR	D					
L14	NR	NR	D	NR	NR					
L15	NR	D	NR	D	D					
L16	NR	NR	D	NR	NR					
L17	NR	NR	D	NR	NR					
L18	NR	D	NR	NR	NR					
L19	NR	D	NR	NR	NR					

A - ACCESS TO ADJACENT COMPONENTS
B - DEBOND
D - DAMAGE
G - DEGRADED
NR - NO REPLACEMENTS TOOK PLACE

NOTE:
REFER TO FIGURE 13 AND FIGURE 14 FOR MLGD THERMAL BARRIER LOCATION REFERENCES.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

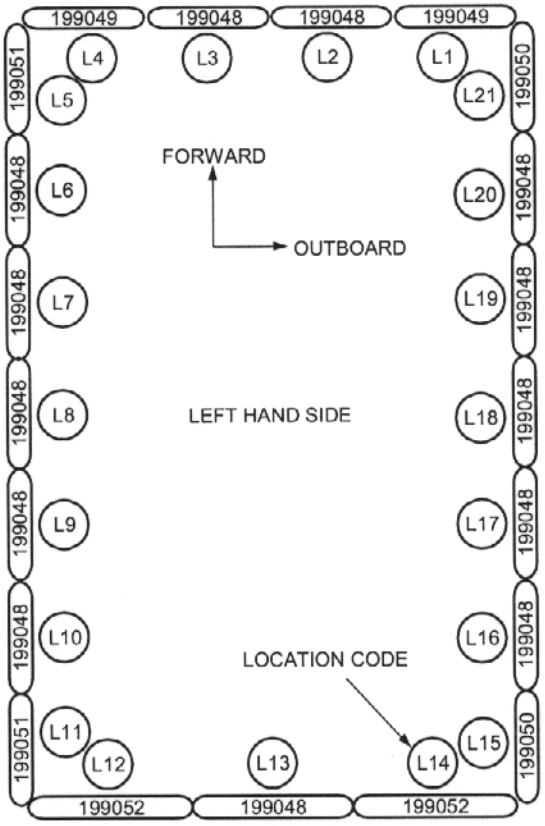
Table 11. OV-104 MLGD Thermal Barrier Replacement History (cont'd)

BARRIER	POST-FLIGHT NUMBER									
	20	21	22	23	24	25	26	27	28	29
L20	NR	D	NR	NR	NR					
L21	D	D	NR	D	NR					
R1	NR	NR	NR	NR	D					
R2	D	NR	NR	NR	D					
R3	NR	D	NR	NR	D					
R4	NR	NR	NR	D	NR					
R5	NR	NR	NR	D	NR					
R6	NR	NR	NR	NR	NR					
R7	NR	NR	NR	NR	NR					
R8	NR	NR	NR	NR	NR					
R9	D	NR	NR	NR	NR					
R10	D	NR	NR	NR	NR					
R11	D	NR	NR	NR	NR					
R12	NR	D	NR	D	D					
R13	D	D	NR	NR	NR					
R14	NR	D	NR	NR	D					
R15	NR	D	D	D	D					
R16	NR	NR	NR	NR	D					
R17	NR	NR	NR	NR	NR					
R18	NR	NR	D	NR	NR					
R19	NR	NR	NR	D	NR					
R20	NR	D	NR	NR	NR					
R21	NR	D	NR	NR	D					

A - ACCESS TO ADJACENT COMPONENTS
B - DEBOND
D - DAMAGE
G - DEGRADED
NR - NO REPLACEMENTS TOOK PLACE

NOTE:
REFER TO FIGURE 13 AND FIGURE 14 FOR MLGD THERMAL BARRIER LOCATION REFERENCES.

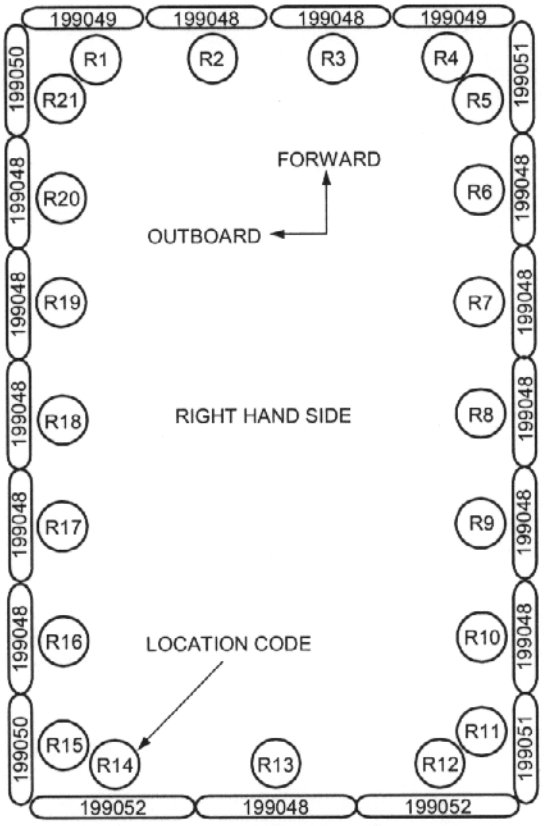
Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



VIEW LOOKING UP

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Figure 13. Main Landing Gear Door Thermal Barrier Location References, Left Hand Side



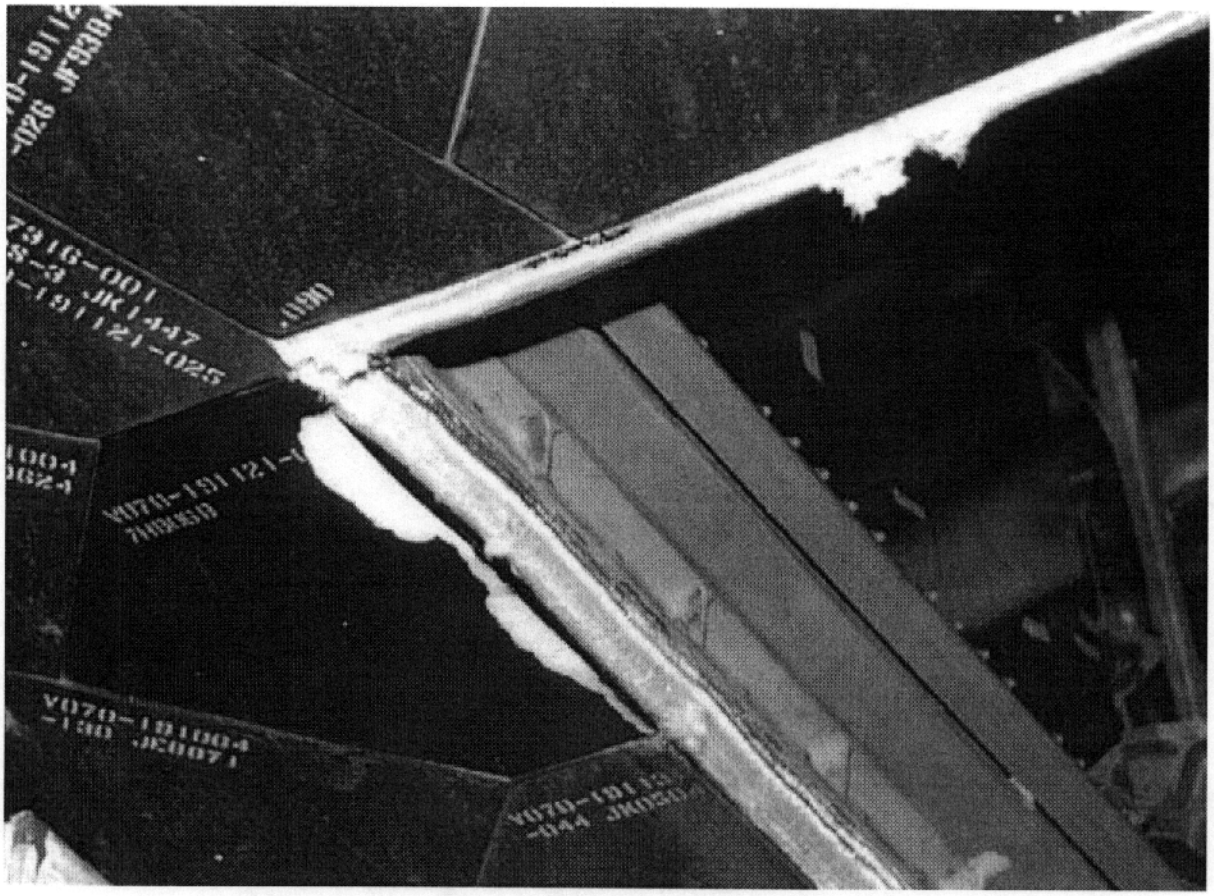
VIEW LOOKING UP

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Figure 14. Main Landing Gear Door Thermal Barrier Location References, Right Hand Side

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

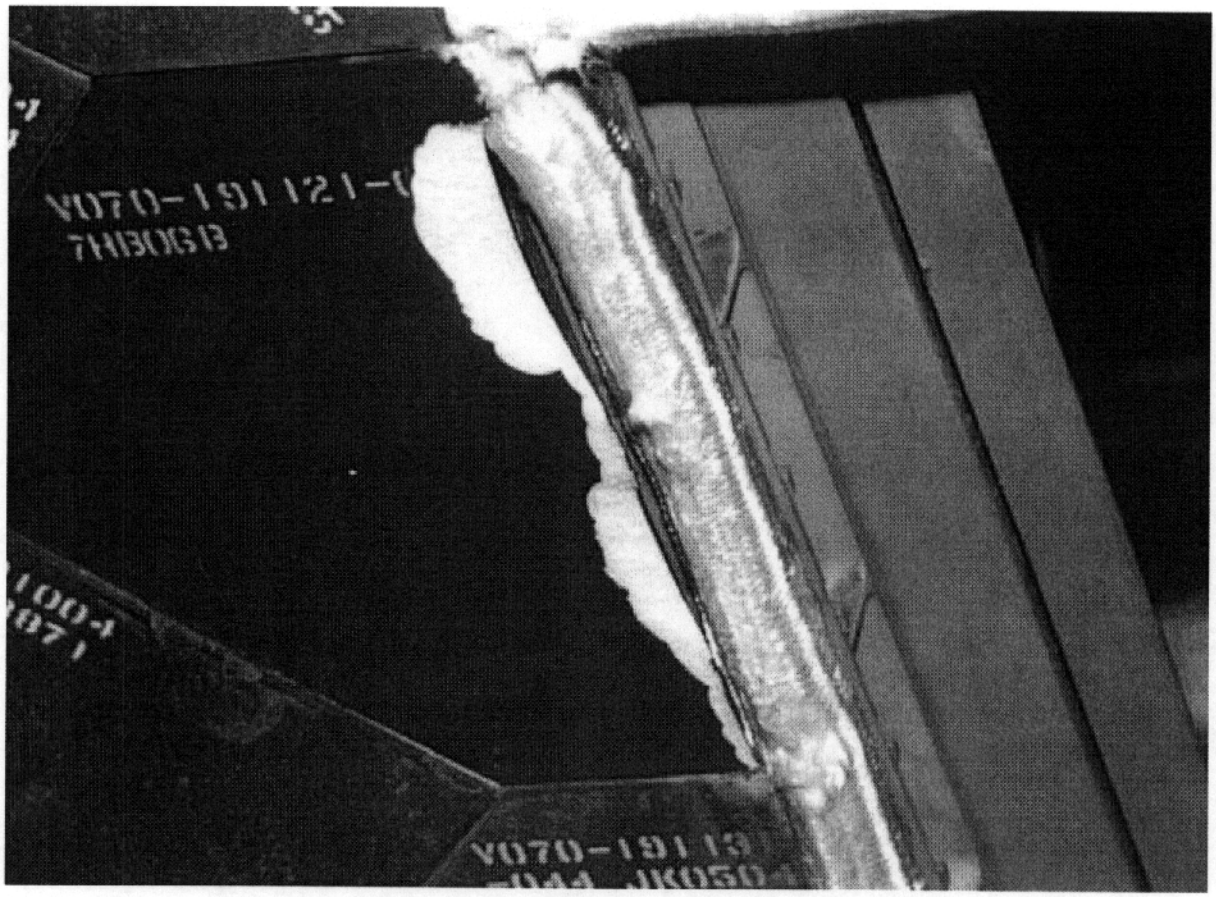


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 12. Right Hand MLGD OML Tile (V070-191121-024) Damage

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

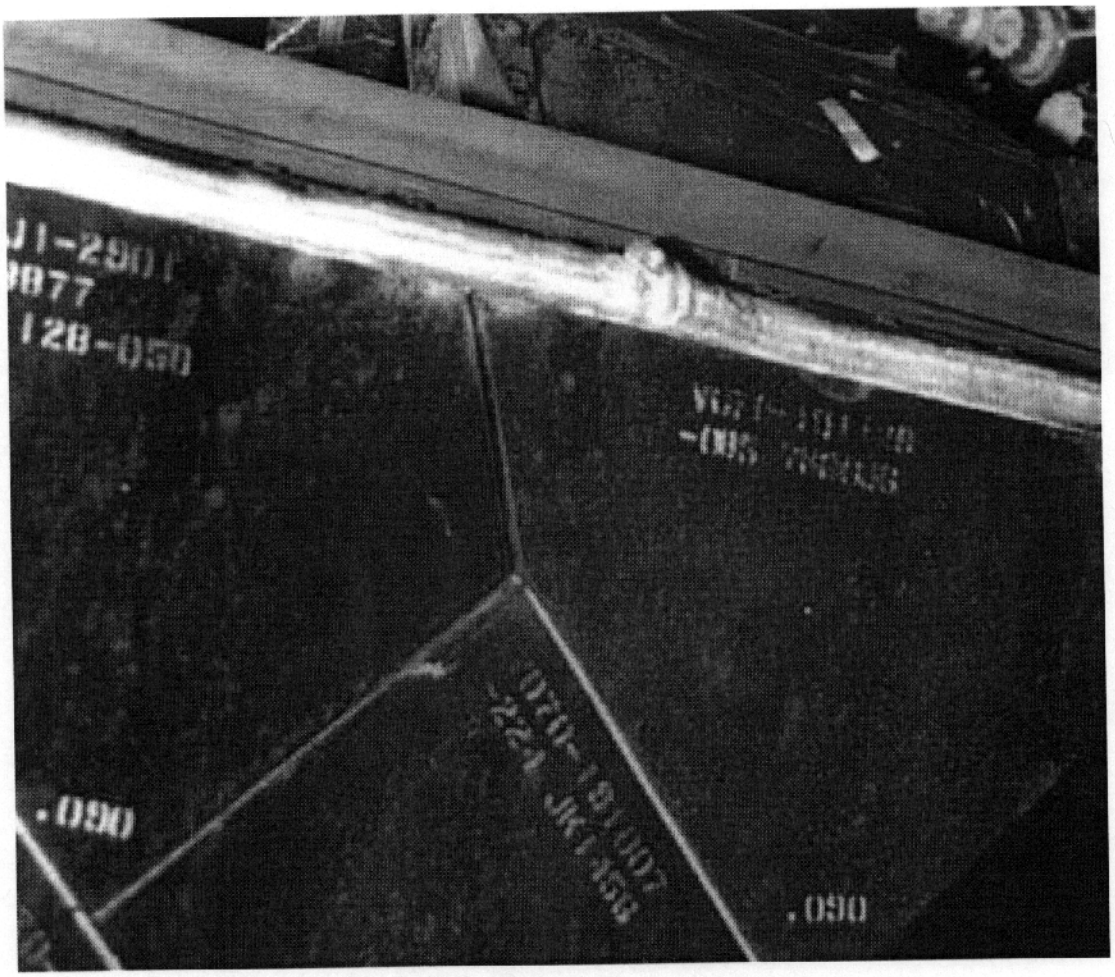


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 13. Right Hand MLGD Tile and Thermal Barrier Damage, Close-up View

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 14. Typical Wear and Tear for MLGD Thermal Barriers

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.1.4 Reinforced Carbon-Carbon/Leading Edge Structural Subsystem

(M. Gordon/G. Grant)

In general, the LESS was in nominal post-flight condition, however, there was one small impact damage that exceeded ML0601-0002 to the aft ET arrowhead plate that was documented during V6028.

The MC621-0007-7010 aft arrowhead plate (S/N 39AH002, 5th flight) sustained a respectable 0.25 inch by 0.25 inch by 0.20 inch damage on the left inboard corner edge at the intersection of the bearing plate and the forward RCC plate. The damage was reported on TES-4-25-0383. Despite these large dimensions, there was no exposed carbon and the damage was repaired per ML0601-9026 procedure TPS-365 method A. The probable cause of the damage of the 39AH002 plate is from pyrotechnic shock causing the brittle SiC lip to break.

There were no damages to the mating arrowhead, MC621-0007-7009 (S/N 13AH001, 1st flight), including the beveled edge across the RCC-to-RCC gap of the noted damage to 39AH002. The forward plate did exhibit rather impressive discoloration on its IML surface. These discolored areas are common and were deemed acceptable in accordance with ML0601-0002, 4.12.2.

The V070-399441 gap filler continues to perform within technical expectations as indicated in figure 15.

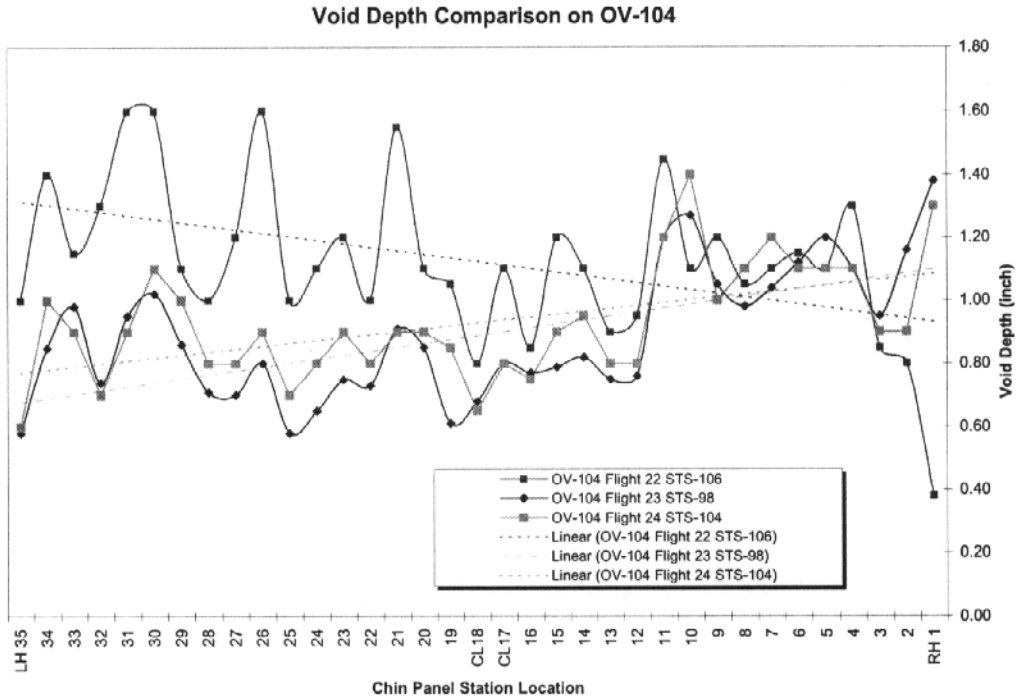


Figure 15. OV-104 Gap Filler Compression Recession Measurements

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

With the exception of the two WLE tile damages, the overall conditions and appearance of the LESS was excellent. The Type A sealant appeared to be in nominal post-flight condition. The fourth flight of the recently refurbished RCC WLE is continuing to perform within expectations. No unexpected individual pinhole or pinhole clusters were noted.

Because of the torrential rain exposure of the vehicle following STS-98, the wet insulator inspection was performed in accordance with OMRS V09AJ0.051 per B-type TPS TES-4-25-037. Four spar insulators were inspected using a video borescope at locations 10L, 10R, 17L, and 17R. The visual inspection at 10R, 17L, and 17R were unremarkable. A report of an expanded insulator at the 10L location was addressed by removing the insulator (and consequently the lower access panel) for a hands-on visual inspection. Following the resolution of insulator removal difficulty from a slight expansion in the face sheet on the forward face of the insulator (as documented in PR TES-4-25-0390), the V070-191310-123 component was removed. The expanded area was manually depressed and massaged to restore the design dimensions of the insulator. The entire insulator was verified within the requirements of ML0311-0022 and ML0601-0002 criteria per the inspection performed in TES-4-25-037. The insulator was subsequently installed per TES-4-25-037.

Several of the lower LESS access carrier panel TPS installations were showing signs of wear. The Engineering walkdown was performed to satisfy OMRSD inspections to verify the integrity of the interface. Two occurrences of tile slumping were reported on the right wing. During the inspection it was determined that several locations would need Ames gap fillers to increase compression of the horsecollar gap fillers. A summary of carrier panel removal activity, which were all required to support structures rework or inspection, is included in table 12.

Table 12. LESS Carrier Panel Activity Post STS-104, OV-104 Flight 24

LESS CARRIER PANEL NO.	DISCREPANCY	ACTION TAKEN
LH 5, 6, 8, 9, 13, 14, 16, 18, & 19	HORSECOLLAR GAP FILLER ASSEMBLIES WERE DEGRADED AND EXHIBITED LOW FRICTION/COMPRESSION.	INSTALL AMES GAP FILLERS TO INCREASE COMPRESSION, PER ML0601-9026 PROCEDURE TPS-316.
LH 10	CONTAMINATION OBSERVED DURING STS-98 DFRC OPERATIONS (WHITE RESIDUE) NEEDED FOLLOW-UP (POST STS-104) INSPECTION.	TES-4-25-037 AUTHORIZED REMOVAL OF UPPER ACCESS CARRIER PANELS #10 & #17 (BOTH RH & LH); PERFORM EVALUATION OF INTERNAL CAVITIES; LH #10 INSULATOR NEEDED FURTHER EVALUATION WHICH ALSO PROMPTED REMOVAL OF LOWER LESS CARRIER PANEL #10. UPPER AND LOWER LESS CARRIER PANELS WERE REINSTALLED FOLLOWING EVALUATION OF TES-037.
RH 8, 9, 10, 11, 12, 16, 17, & 18	HORSECOLLAR GAP FILLER ASSEMBLIES WERE DEGRADED AND EXHIBITED LOW FRICTION/COMPRESSION.	INSTALL AMES GAP FILLERS TO INCREASE COMPRESSION, PER ML0601-9026 PROCEDURE TPS-316.
RH 13	HORSECOLLAR GAP FILLER ASSEMBLIES EXHIBITED EXCESSIVE RECESSION.	INSTALL TADPOLE GAP FILLER TO IMPROVE RECESSION, PER ML0601-9026 PROCEDURE TPS-316.
RH 14	SLUMPED TILE CORNER (RWNG-4-25-4033).	GRIND OUT SLUMPAGE AND REPAIR PER TPS-330.
RH 15	SLUMPED TILE CORNER (RWNG-4-25-4034).	GRIND OUT SLUMPAGE AND REPAIR PER TPS-330.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.1.5 External Tank Door Area

(X. Dominguez)

The post-flight evaluation of the periphery thermal barriers for both the left and right hand ET doors revealed that the barriers were degraded, brittle, or had tears in the OML fabric, and the black RTV exhibited a "chalky" appearance typical of flown ET thermal barriers (refer to photo 15). The entire set of ET thermal barriers on OV-104 post flight 24 have accumulated two flights of the maximum three-flight limit.

Due to problems related to maintaining required thermal barrier finished height dimensions during manufacturing, CHIT J5468 was submitted to remove all the barriers and provide a full test set of thermal barriers for evaluation. The test set of thermal barriers were fabricated with a thicker internal support. The data gathered from this installation will be used to possibly modify the drawing requirements for future ET thermal barriers. All of the ET thermal barriers on the right and left hand doors were removed per CHIT J5468. Due to various conditions of degradation to the flown barriers, after the test set of barriers were evaluated, a complete new set of design barriers were installed. All flown barriers were scrapped (refer to table 13 for summary of ET door replacement history).

Several damages to tile in the ET door area were incurred during the STS-104 mission. Evaluation of the beveled lip damage on the V070-395055-216 tile determined that the appropriate action was to remove and replace the tile (refer to photo 16). The V070-395055-206 tile (refer to photo 17) sustained a minor corner damage at the interface to the latch fitting. This damage was within criteria suitable for rework utilizing a standard procedure putty-type repair. The V070-395037-153 tile (refer to photo 18) and approximately six tiles outboard of the right ET door cavity (refer to photo 19) and six tiles at the aft outboard corner of the left ET door cavity (refer to photo 15) sustained impact damages that were also within criteria suitable for rework utilizing standard repair procedures. A discoloration observed on the Inconel fingers of the leading edge right ET door (refer to photo 20) was evaluated by engineering for degradation. Evaluation determined no degradation/slumping of the fingers had occurred. The discoloration was cleaned off utilizing approved specification solvents. All other components of the ET door area were in typical condition.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 15. Aft Outboard Corner Left Hand ET Door Thermal Barriers and Tile Damage, Overall View

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 13. OV-104 External Tank Door Replacement History

BARRIER	POST-FLIGHT NUMBER									
	20	21	22	23	24	25	26	27	28	29
L1	O	NR	G	D/G	T					
L2	O	NR	G	NR	T					
L3	O	NR	G	G	T					
L4	O	NR	G	D/G	T					
L5	O	NR	G	NR	T					
L6	O	NR	G	NR	T					
L7	O	NR	G	NR	T					
R1	O	D	G	D/G	T					
R2	O	NR	G	NR	T					
R3	O	D	G	NR	T					
R4	O	D	G	NR	T					
R5	O	NR	G	NR	T					
R6	O	NR	G	NR	T					
R7	O	NR	G	NR	T					

B - DEBOND
D - DAMAGE
G - DEGRADED
L - 3 FLIGHT CYCLE LIMIT
A - ACCESS TO ADJACENT COMPONENTS
O - REMOVAL IN SUPPORT OF OMDP OPERATIONS
NR - NO REPLACEMENTS TOOK PLACE
T - REPLACED DUE TO ENGR EVAL OF TEST PARTS

NOTE:
REFER TO FIGURE 16 FOR ETD THERMAL BARRIER LOCATION REFERENCES.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

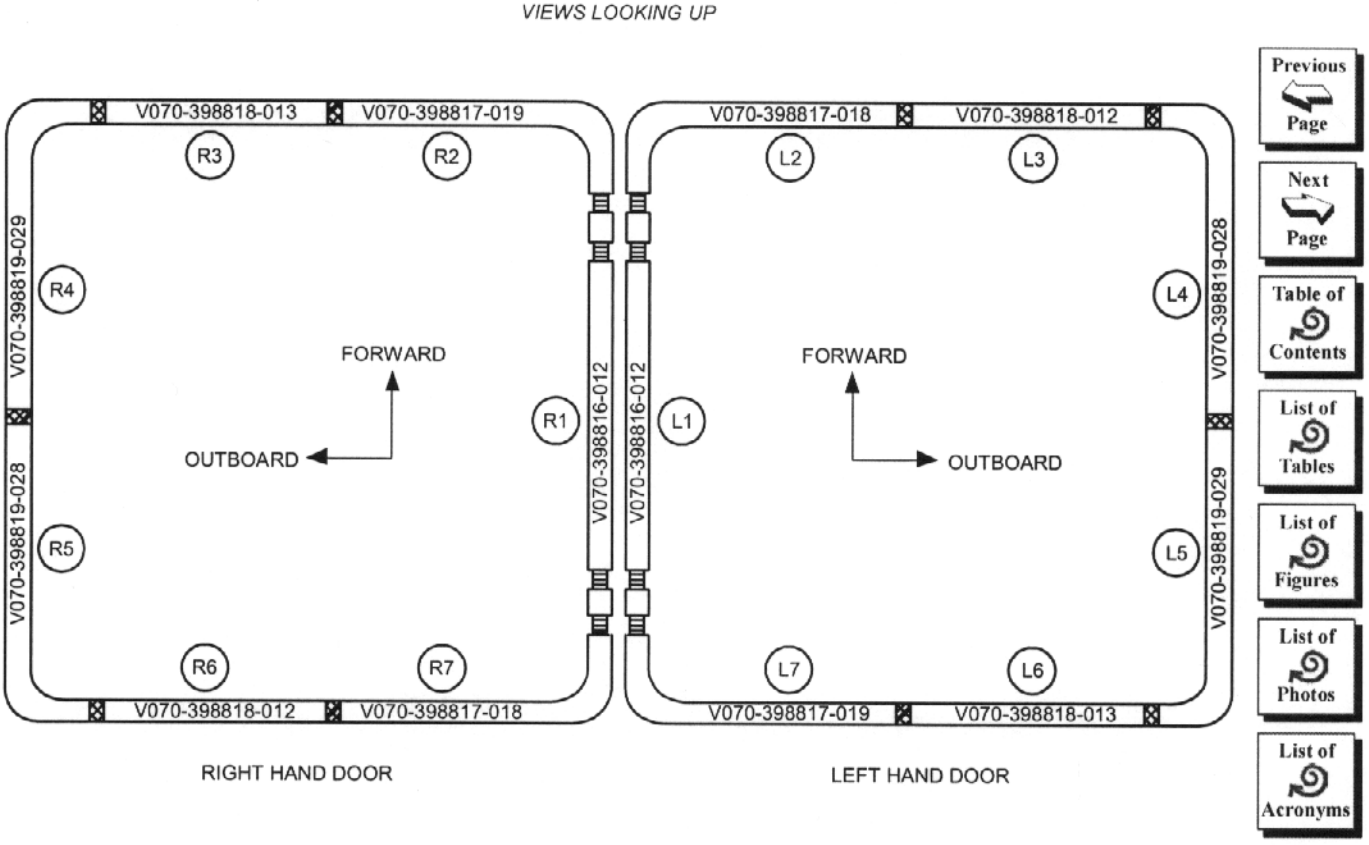
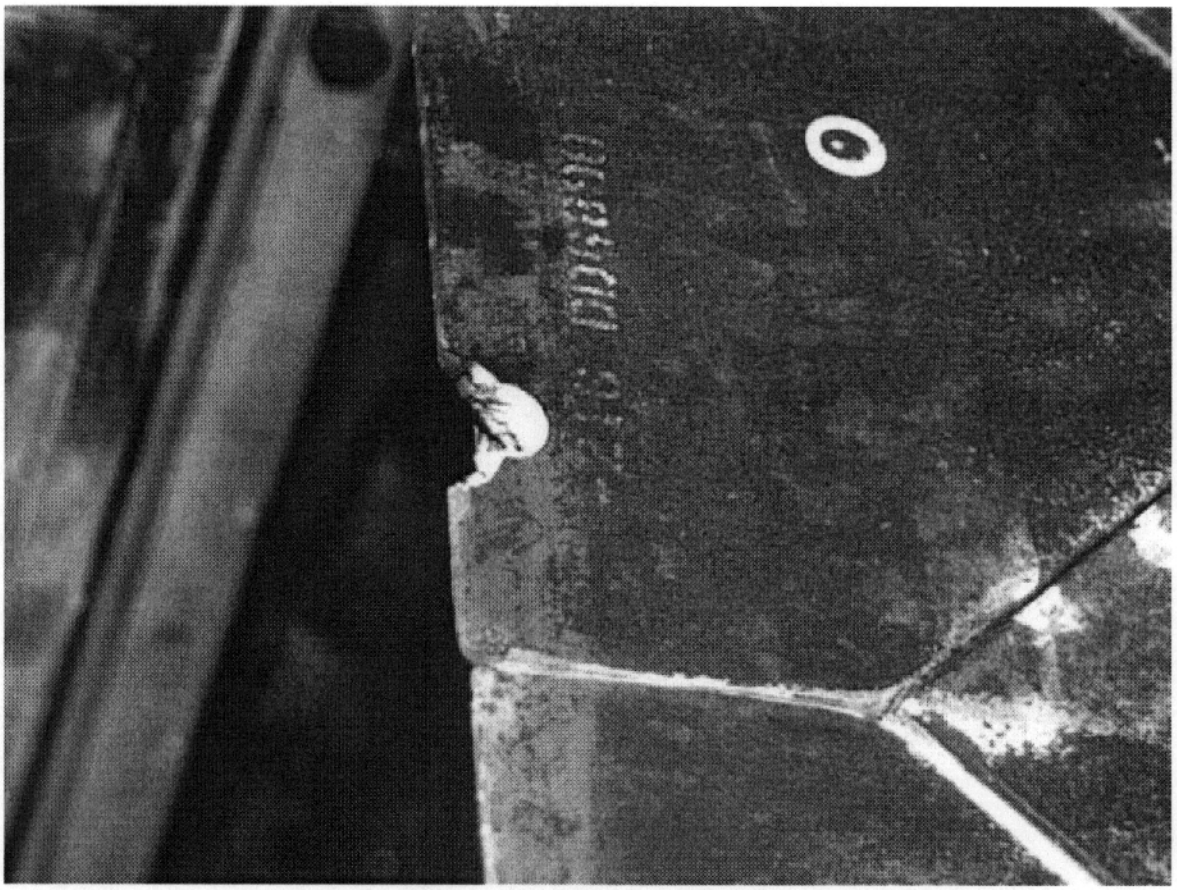


Figure 16. External Tank Thermal Barrier Location References

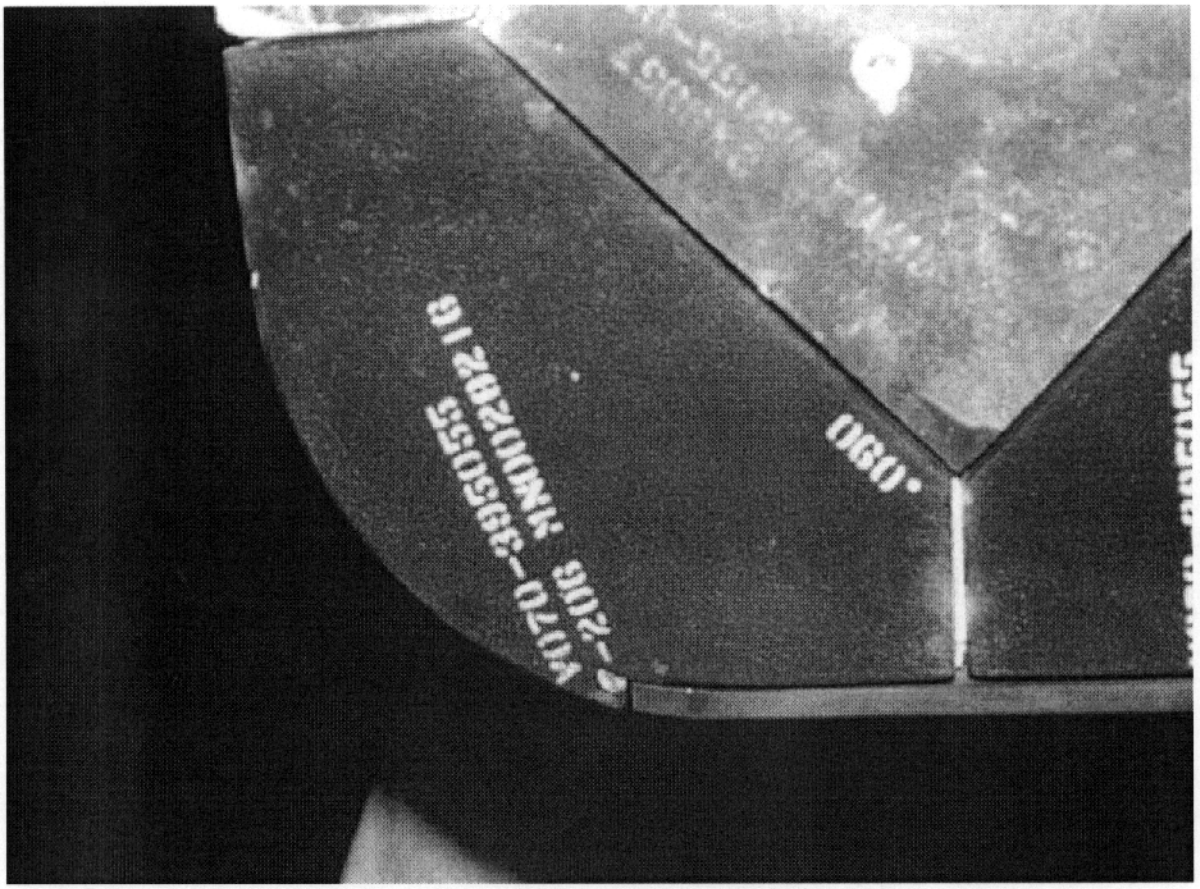


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 16. Damaged Leading Edge Tile (V070-395055-216) on Right Hand ET Door

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

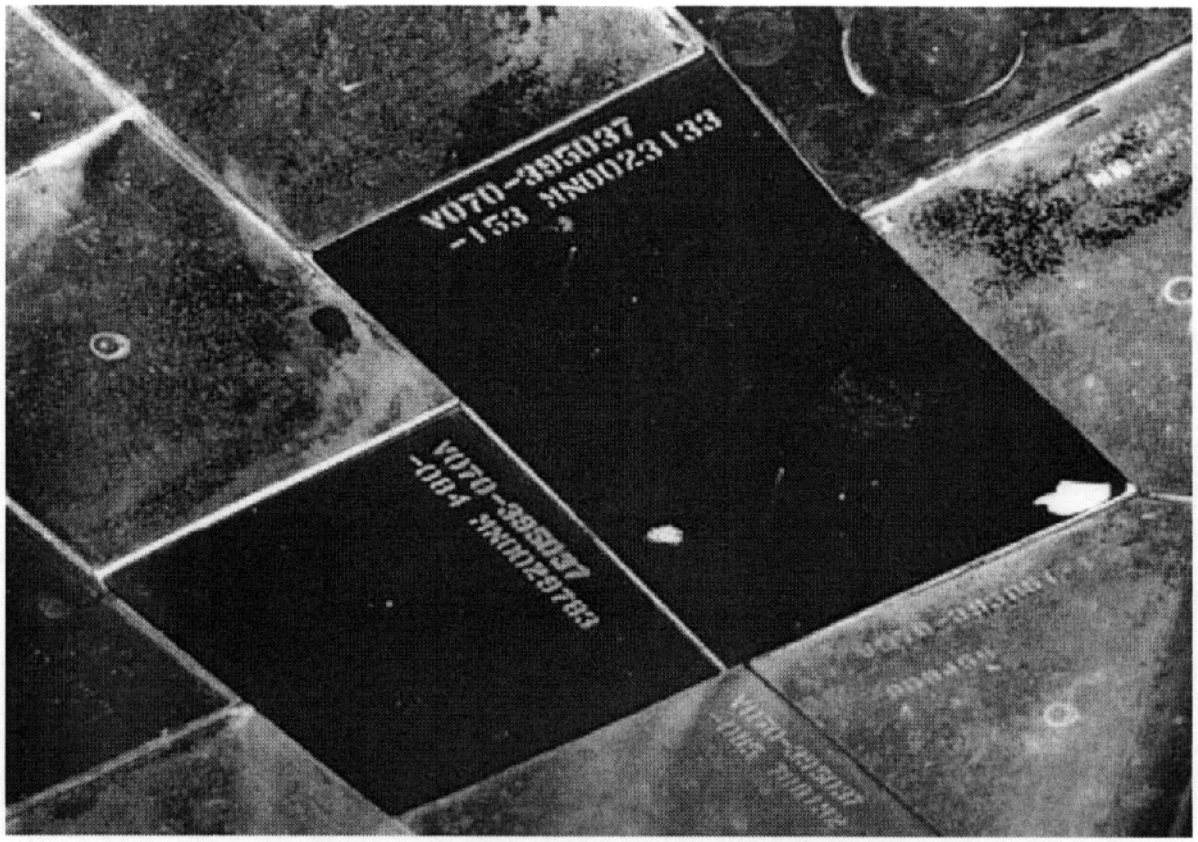


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 17. Damaged Corner Tile (V070-395055-206) on Right Hand ET Door

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

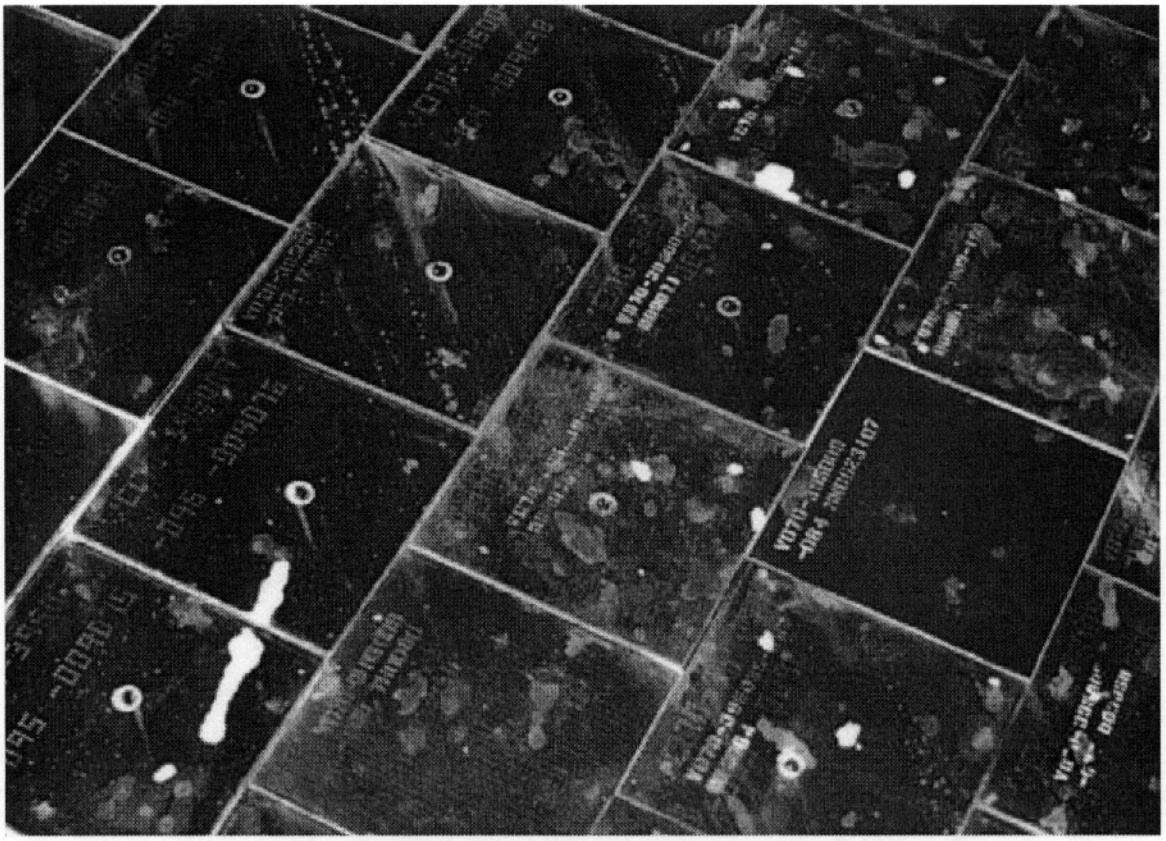


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 18. OML Damage on Tile (V070-395037-153)

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

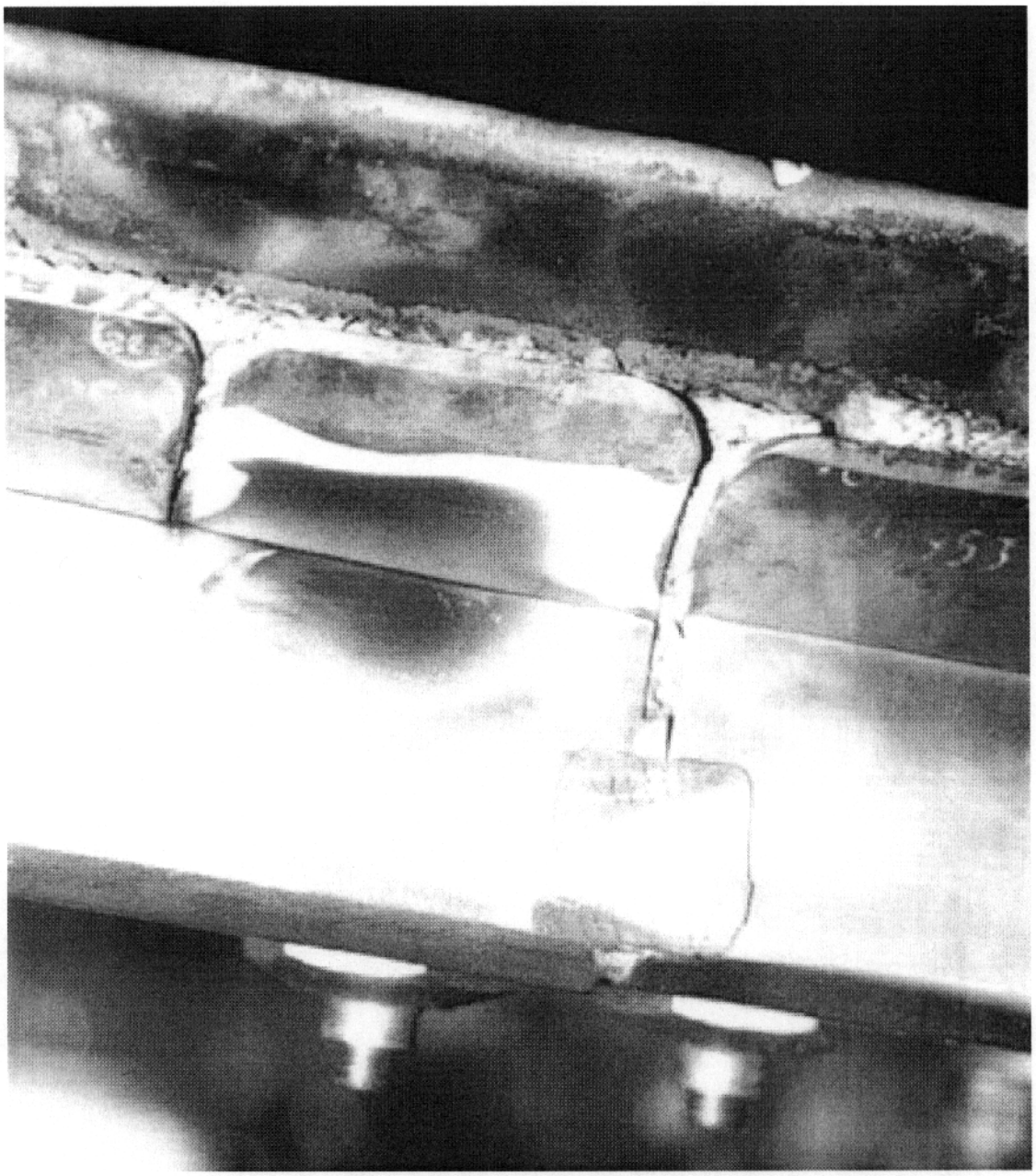


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 19. Acreage OML Tile Damage Inboard of Left Hand Aft Corner of ET Door Cavity

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 20. Discolored Inconel Fingers on Right Hand ET Door

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

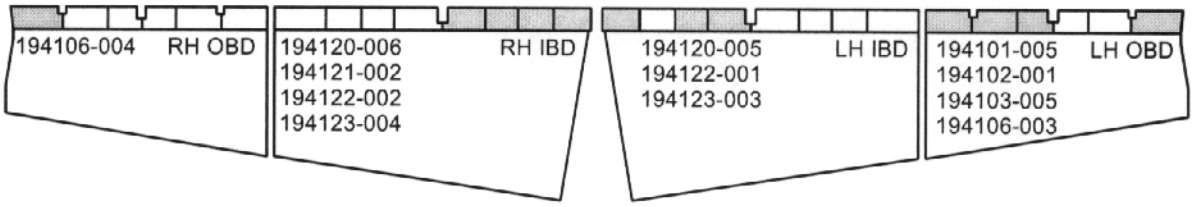
5.1.6 Elevon Area

(G. Grant)

The overall condition of the elevon cove was outstanding. No significant degradation of the TPS was observed. Several carrier panel removals were required to support turnaround and OMRSD inspection requirements.

Slumping was observed on several tiles on the inboard edge of the outboard elevon (ablator) area. These conditions were noted on both the left and right hand sides. The damages were repaired by grinding out the glazed and slumped material and completed using TPS-330 putty-type fill repairs. The gap fillers were replaced at the associated tile-to-tile intersections. A complete listing of carrier panel removals and associated information is included below in table 14 for historical purposes.

Table 14. Summary of Lower Elevon Cove Carrier Panel Removal History



ELEVON	PANEL NUMBER	ASSOCIATED WAD	PART NUMBER (V070-)	REASON REMOVED	RESOLUTION
LH OUTBOARD	194101-005 194102-001 194103-005	STR-4-25-6219 STR-4-25-6219 STR-4-25-6219	V070-198000-030 V070-198000-030 V070-198000-030	IBD SEAL HAS FLOW RATE ABOVE MAXIMUM ALLOWABLE	REMOVE CARRIER PANELS; REWORK SECONDARY SEAL SYSTEM; REINSTALL CARRIER PANELS
	194106-003	V6059.004	NA	OMRSD INSPECTION	ROUTINE REFURBISHMENT; REINSTALLATION
RH OUTBOARD	194106-004	V6059.004	NA	OMRSD INSPECTION	ROUTINE REFURBISHMENT; REINSTALLATION
LH INBOARD	194120-005	LWNG-4-25-3475	V070-191056-004	GAP FILLER FRAYED	REMOVE/REPLACE GAP FILLER
	194122-001 194123-003	STR-4-A0342 STR-4-A0342	V070-198313-002 V070-198313-002	POLYIMIDE SEAL CHIPPED; FLOWN RESTRICTED WITHOUT REWORK	REMOVE CARRIER PANELS; REPLACE SEAL; REINSTALL CARRIER PANELS
RH INBOARD	194120-006 194121-002 194122-002 194123-004	STR-4-25-6214 STR-4-25-6214 STR-4-25-6214 STR-4-25-6214	V070-198000-031 V070-198000-031 V070-198000-031 V070-198000-031	IBD SEAL HAS FLOW RATE ABOVE MAXIMUM ALLOWABLE	REMOVE CARRIER PANELS; REWORK SECONDARY SEAL SYSTEM; REINSTALL CARRIER PANELS

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.2 Upper Fuselage and Upper Wings

5.2.1 General

(X. Dominguez)

The general condition of the TPS components on the upper fuselage and upper wing surfaces was typical as seen in previous flights. Damages were minor in nature and consisted primarily of FI blanket tears/fraying and chips and gouges in the OML coating of the upper forward fuselage/FRCS tiles. The periphery FRCS thermal barriers exhibited typical post-flight degradation of the black RTV coating. The various minor discrepancies were typical and within criteria suitable for repair per standard procedure specifications.

5.2.2 Forward Reaction Control System

(C. Snapp)

TPS on the FRCS experienced typical post-flight degradation and was in nominal post-flight condition. Many of the thermal barriers on the FRCS had areas of damage and fraying. The most notable was the fraying on the V070-398303-001 thermal barrier that was 6 inches in length. All the frays were repairable per standard procedures. A previous MR patch on the V070-398161-001 thermal barrier had a tear in the fabric approximately 0.15 inch in length. The condition of the patch warranted removal and replacement with a new MR patch. Several small tile and blanket damages were repaired utilizing standard procedures. Several locations on the FRCS were found to have degraded gap fillers. The gap fillers were removed and replaced per standard procedures. Thermal barriers around the periphery of the FRCS exhibited typical post-flight degradation of the black RTV coating. This coating was reworked by refurbishing the RTV coating per standard repair procedures.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.2.3 Windows

(E. Marchitti)

Post-flight windows inspection revealed 161 new impacts spread over 7 windows as a result of the STS-104 mission. The left hand middle (W2, 27 impacts) and right hand overhead (W7, 12 impacts) thermal panes both had damages severe enough to result in scrap dispositions. The left hand overhead (W8, 4 impacts) window also had flight damage which resulted in negative margin for the existing installation, but this thermal pane was demonstrated by stress analysis to usable as a spare in the flipped configuration. The right hand middle (W5, 3 impacts) thermal pane also had flight damage. This window was shown by stress analysis to be acceptable for continued flight use, but it must be restricted to OV-103 and subs. Finally, impact flaws detected on the left hand side (W1, 1 impact), left hand forward (W3, 31 impacts) and right hand forward (W4, 83 impacts) thermal panes were all demonstrated by analysis to be acceptable for continued flight use. A complete history of window flight damage for OV-104 is given in table 15.

Table 15. OV-104 Window Flight Damage History

POST-STS	FLIGHT	DATE	WINDOW NUMBER	DAMAGE	DISPOSITION
28	1	10-03-85	NA	NONE	NA
31	2	11-26-85	1 2 4	PIT PIT PIT	SCRAP ACCEPTABLE SCRAP
27R	3	12-02-88	NA	NONE	NA
30R	4	05-04-89	6	PIT	SCRAP
34	5	10-18-89	NA	NONE	NA
36	6	02-28-90	NA	NONE	NA
38	7	11-15-90	1 3 4 6	PIT 3 PITS PIT 2 PITS	SCRAP ACCEPTABLE ACCEPTABLE SCRAP
37	8	04-05-91	NA	NONE	NA
43	9	08-02-91	5	PIT	SCRAP
44	10	11-24-91	1 4 6	PIT BRUISE PIT	SCRAP SCRAP SCRAP
45	11	03-24-92	6	PIT	SCRAP
46	12	09-31-92	6 7 8	SCRATCH PIT SCRATCH	ACCEPTABLE SCRAP SCRAP
66	13	11-03-94	1 2 4 5	2 PITS 3 PITS 2 PITS 4 PITS	REMOVE SCRAP ACCEPTABLE ACCEPTABLE

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 15. OV-104 Window Flight Damage History (cont'd)

POST-STS	FLIGHT	DATE	WINDOW NUMBER	DAMAGE	DISPOSITION
71	14	06-27-95	5 6 4	2 PITS PIT PIT	SCRAP REMOVE ACCEPTABLE
74	15	11-12-95	2 5	PIT PIT	ACCEPTABLE ACCEPTABLE
76	16	03-22-96	3 4 5 6	10 PITS 8 PITS PIT PIT	ACCEPTABLE ACCEPTABLE ACCEPTABLE SCRAP
79	17	09-16-96	1 4 5 6 7 8	PIT 7 PITS PIT 4 PITS PIT PIT	ACCEPTABLE ACCEPTABLE SCRAP REMOVE SCRAP SCRAP
81	18	01-12-97	2 5 6	2 PITS 3 PITS 2 PITS	ACCEPTABLE ACCEPTABLE SCRAP
84	19	05-15-97	1 2 3 9	5 PITS 2 PITS 13 PITS PIT	SCRAP ACCEPTABLE ACCEPTABLE ACCEPTABLE
86	20	09-25-97	2 3 4 5 11	4 PITS 18 PITS 54 PITS 12 PITS PIT	ACCEPTABLE ACCEPTABLE ACCEPTABLE ACCEPTABLE OK FOR OMDP
101	21	05-29-00	1 3 4 5 6 7	PIT/SCRATCH 12 PITS 22 PITS 46 PITS 4 PITS 2 PITS	ACCEPTABLE ACCEPTABLE SCRAP ACCEPTABLE ACCEPTABLE ACCEPTABLE
106	22	09-20-00	1 2 3 4 5 8 9 11	PIT 5 PITS 14 PITS 24 PITS 23 PITS PIT PIT PIT	SCRAP ACCEPTABLE ACCEPTABLE ACCEPTABLE ACCEPTABLE REMOVE ACCEPTABLE ACCEPTABLE

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 15. OV-104 Window Flight Damage History (cont'd)

POST-STS	FLIGHT	DATE	WINDOW NUMBER	DAMAGE	DISPOSITION
98	23	02-20-01	2	2 PITS	ACCEPTABLE
			3	158 PITS	ACCEPTABLE
			4	7 PITS	ACCEPTABLE
			5	11 PITS/ 2 BRIUSES	SCRAP
			6	6 PITS/ SCRATCH	SCRAP
			7	PIT	REMOVE
			8	PIT	SCRAP
			11	PIT	REMOVE
104	24	07-24-01	1	1 PIT	ACCEPTABLE
			2	27 PITS	SCRAP
			3	31 PITS	ACCEPTABLE
			4	83 PITS	ACCEPTABLE
			5	3 PITS	RESTRICT
			7	12 PITS	SCRAP
			8	4 PITS	REMOVE

5.2.4 Upper Midfuselage/Payload Bay Doors

(C. Snapp)

The TPS on the midfuselage sidewall and payload bay door acreage was in typical post-flight condition. Discrepancies noted included FI blanket frays, tears adjacent to and on carrier panels, and degraded edge members, all of which were repaired per standard repair procedures. The most significant damages were on the V070-397519-129 FI blanket which had outer fabric missing 5 inches by 0.4 inch with inner batting exposed, and the V070-397519-176 FI blanket which had outer fabric torn 2 inches by 0.1 inch. The V070-397519-129 blanket was repaired with a patch and the V070-397519-176 blanket was repaired with a stitch and coat per standard procedures. There was also an edge member that showed signs of overtemperature on the V070-397057-003 carrier panel which was repaired per standard procedures. Several FI blanket and FRSI debonds/voids were detected, mostly on carrier panels. Debonds and voids that were detected were repaired by rebonding with RTV per standard procedures. Several small tile damages and gap filler damages were also detected and repaired per standard procedures.

The TPS on the payload bay door hinges was also in typical post-flight condition. Inspection of the PLBD hinge area TPS, performed per OMI V6049.009, revealed no areas of scraped or missing MB0125-063 Pyromark coating. There were 12 filler bar/SIP erosions and minimal adjacent tile damages. Filler bar/SIP erosions were repaired by removing the damaged filler bar/SIP and replacing it on an MR basis or paint sealing the damage with elastomeric coating to prevent further propagation. There was a location at left hand hinge number 1 that had debonded filler bar that was repaired per standard procedures. Refer to table 16 for a complete inspection summary of the payload bay door hinge covers.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 16. Payload Bay Door Hinge Cover Inspection Summary

HINGE NUMBER	PISTON GAP (INCHES)	BOUND PISTON	ADDITIONAL DISCREPANCIES (REFER TO FIGURE 17 FOR DISCREPANCY LOCATIONS)
LEFT HAND #1 Xo 602.300	FORWARD: 0.010 TO 0.020 AFT: 0.020 CONST	N N	* SIP ERODED AT 394710-049 TILE 0.5" X 0.2"
LEFT HAND #2 Xo 669.800	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
LEFT HAND #3 Xo 737.300	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
LEFT HAND #4 Xo 783.550	FORWARD: 0.000 CONST AFT: 0.005 TO 0.010	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
LEFT HAND #5 Xo 850.600	FORWARD: 0.000 TO 0.010 AFT: 0.010 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
LEFT HAND #6 Xo 917.650	FORWARD: 0.003 TO 0.010 AFT: 0.010 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
LEFT HAND #7 Xo 966.350	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #8 Xo 1033.400	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #9 Xo 1100.450	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #10 Xo 1144.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #11 Xo 1204.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #12 Xo 1264.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
LEFT HAND #13 Xo 1297.000	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 16. Payload Bay Door Hinge Cover Inspection Summary (cont'd)

HINGE NUMBER	PISTON GAP (INCHES)	BOUND PISTON	ADDITIONAL DISCREPANCIES (REFER TO FIGURE 17 FOR DISCREPANCY LOCATIONS)
RIGHT HAND #1 Xo 602.300	FORWARD: 0.000 TO 0.015 AFT: 0.000 CONST	N N	* NO DISCREPANCIES TO REPORT
RIGHT HAND #2 Xo 669.800	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
RIGHT HAND #3 Xo 737.300	FORWARD: 0.000 TO 0.008 AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
RIGHT HAND #4 Xo 783.550	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
RIGHT HAND #5 Xo 850.600	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS
RIGHT HAND #6 Xo 917.650	FORWARD: 0.000 CONST AFT: 0.000 CONST	N N	* SIP ERODED AROUND FASTENER PENETRATIONS * FILLER BAR ERODED AT 393211-003 TILE
RIGHT HAND #7 Xo 966.350	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
RIGHT HAND #8 Xo 1033.400	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
RIGHT HAND #9 Xo 1100.450	FORWARD: NA AFT: NA	NA NA	* RAMPING ON 394067-275 BLANKET ERODED * RAMPING ON 397518-135 BLKT ERODED 0.3" X 0.1"
RIGHT HAND #10 Xo 1144.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
RIGHT HAND #11 Xo 1204.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
RIGHT HAND #12 Xo 1264.200	FORWARD: NA AFT: NA	NA NA	* NO DISCREPANCIES TO REPORT
RIGHT HAND #13 Xo 1297.000	FORWARD: NA AFT: NA	NA NA	* SCRAPING IN PYROMARK (LOC 3)

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

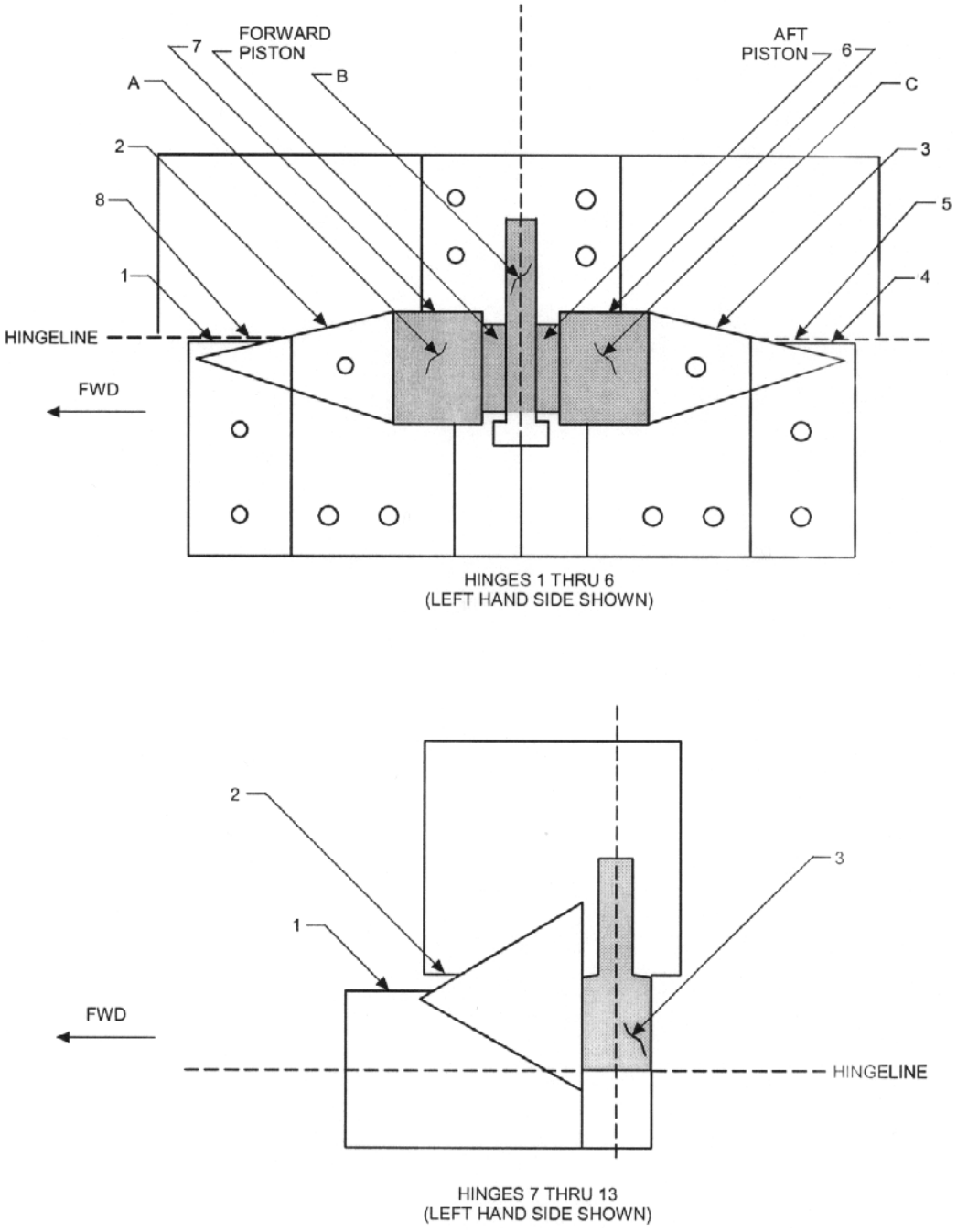


Figure 17. Payload Bay Door Hinge Cover

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.3 Aft Fuselage

5.3.1 General

(X. Dominguez)

The performance of the TPS components on the aft fuselage was excellent with no significant anomalies to report. Typical flight-related damage was evident in the base heat shield area, engine domes, and vertical stabilizer, all of which were repaired or replaced utilizing standard procedures.

5.3.2 Base Heat Shield

(X. Dominguez)

The acreage TPS on the base heat shield was in nominal post-flight condition with a less than average amount of "peppering" on the base heat shield requiring rework (refer to photo 21). Dome heat shield components on engine number 1 at the 6 o'clock position sustained damage/degradation on the blanket and pillow, and DHS blanket on engine number 2 was damaged and frayed at the 9 o'clock position, all warranted removal and replacement. The pillow on engine number 3 at the 6 o'clock position was frayed and damaged, and it too was removed and replaced (refer to photos 22 through 24). All other dome heat shield components were in nominal condition.

5.3.3 Upper Body Flap

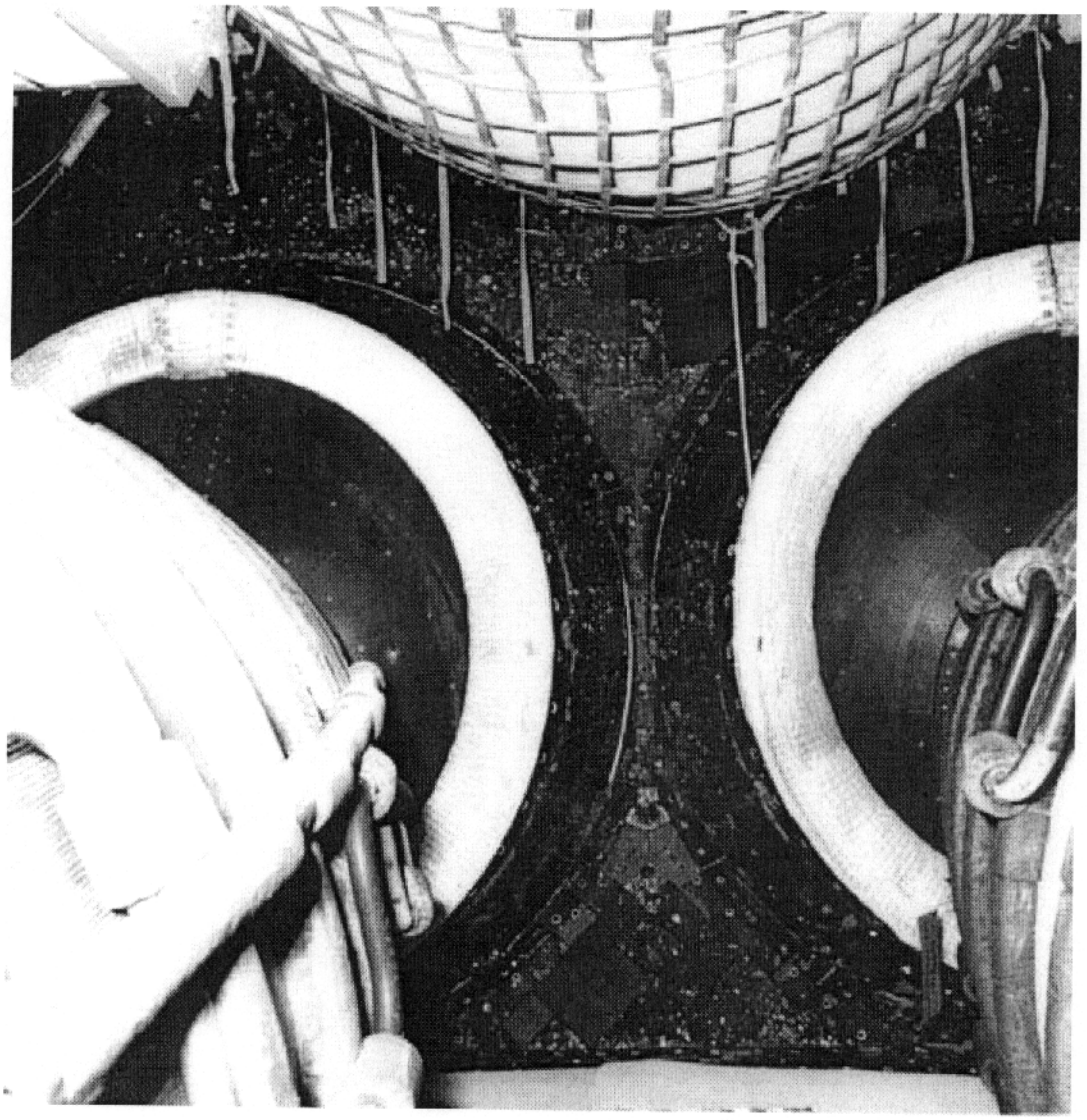
(X. Dominguez)

Overall, the TPS on the upper body flap acreage was in nominal post-flight condition. Areas of minor coating damage were repaired per standard procedures. The flight performance of the TUFI-coated AETB-8 tiles installed on the upper body flap was excellent (refer to photo 25 and photo 26).

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

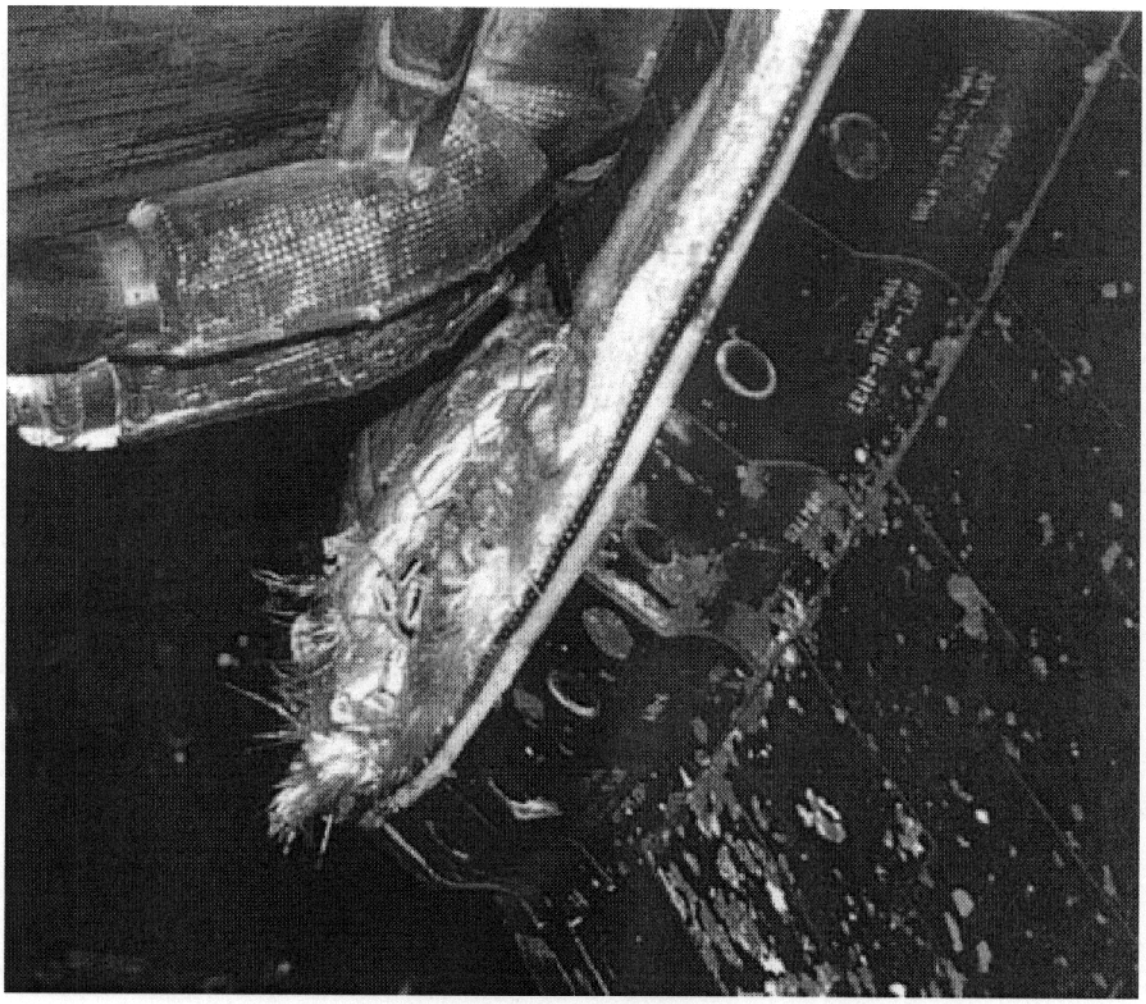


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 21. Peppering Condition on Aft Base Heat Shield

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

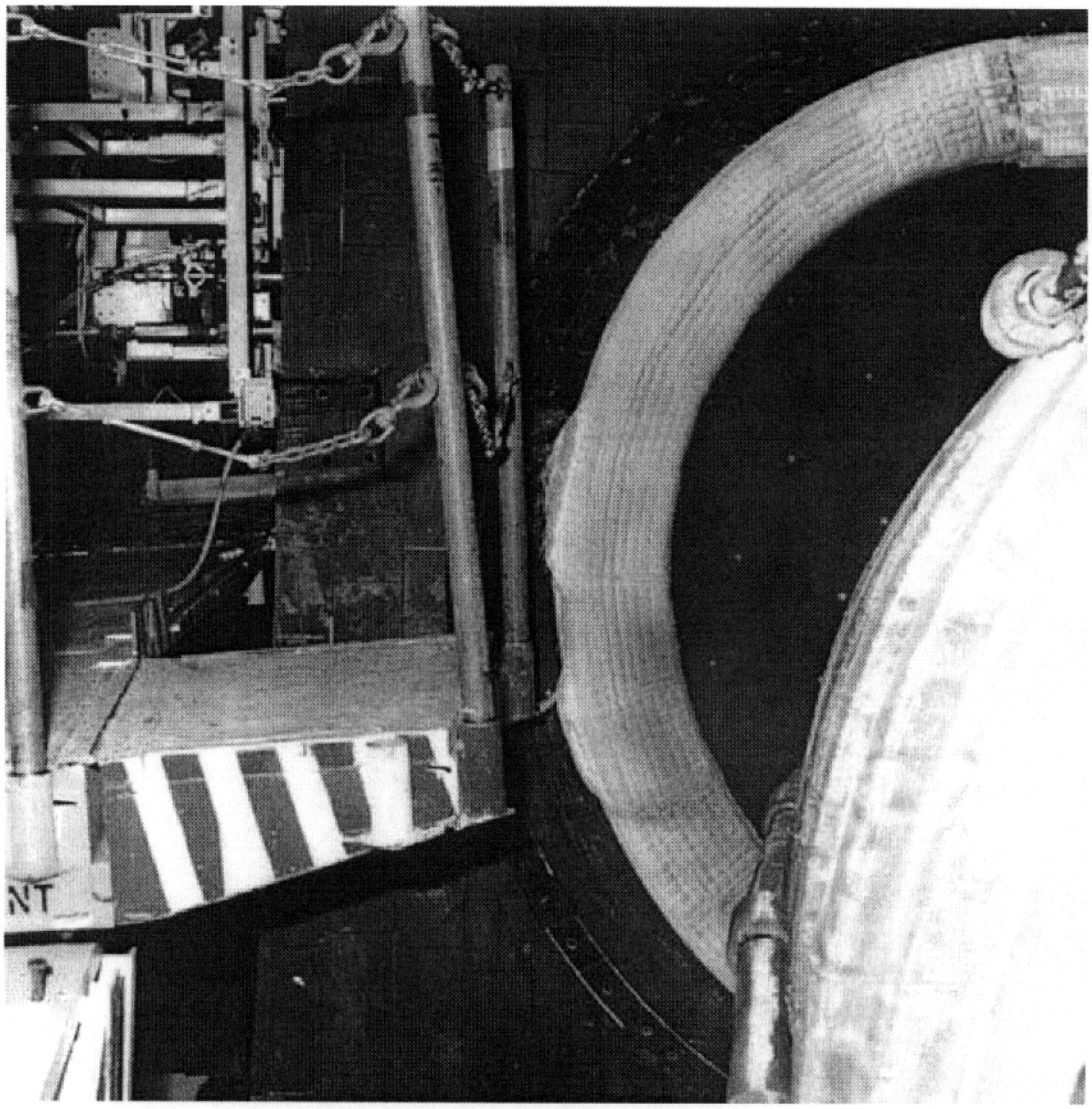


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 22. SSME Number 1 Damaged Dome Heat Shield Blanket and Pillow

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

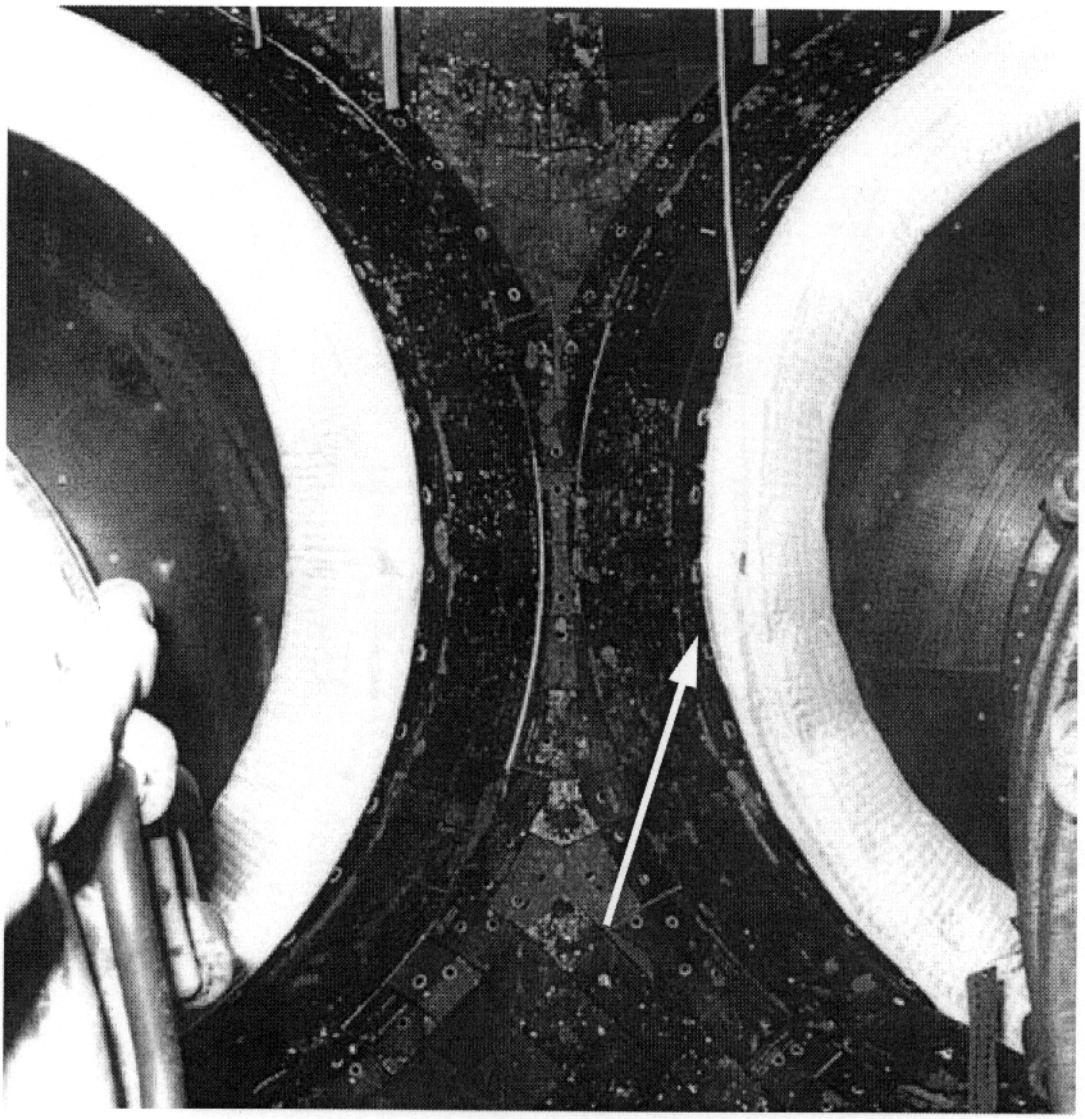


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 23. SSME Number 2 Damaged Dome Heat Shield Blanket

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

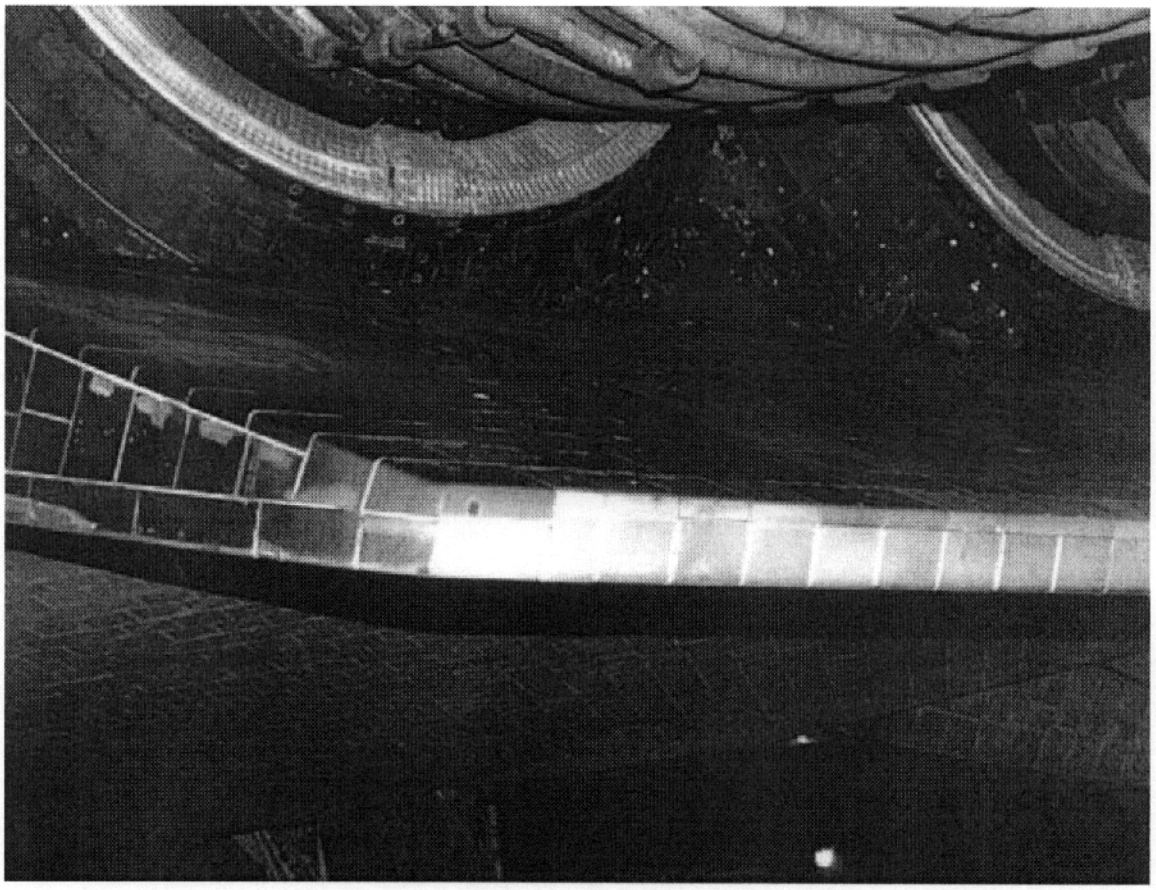


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 24. SSME Number 3 Damaged Dome Heat Shield Blanket

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

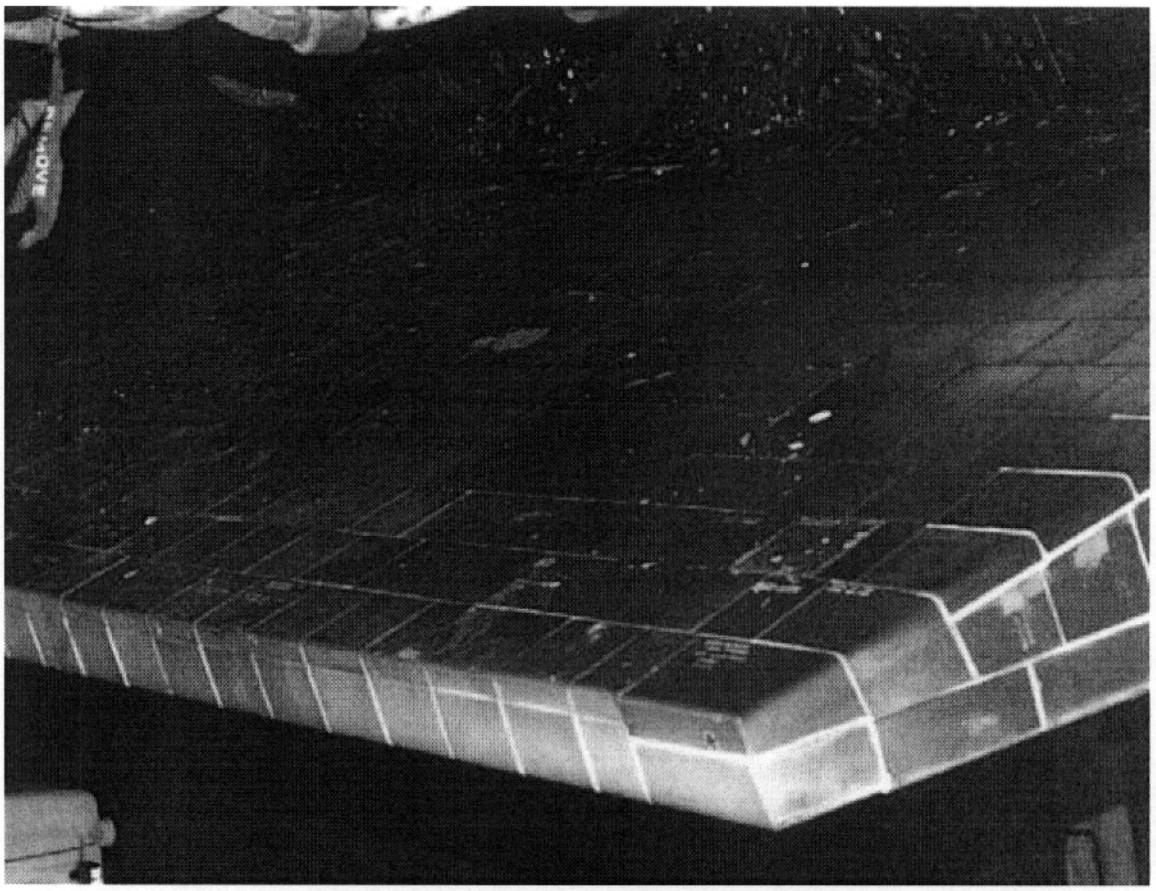


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 25. Upper Body Flap AETB-8 Left Hand Tiles

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 26. Right Hand Upper Body Flap AETB-8 Tiles

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

5.3.4 Vertical Stabilizer and Rudder/Speed Brake

(C. Snapp)

Post-flight inspection of the vertical stabilizer and rudder/speed brake revealed that there were no unusual damages to the TPS beyond normal wear and tear. There were no large areas of blanket damages on the vertical stabilizer or rudder/speed brake. Several small blanket damages were repaired utilizing standard procedures.

The V070-298130-002 right hand split line thermal barrier had the end portion of the barrier torn open and was subsequently removed and replaced (refer to photo 27). The V070-298128-001 left hand split line thermal barrier had degraded RTV that was repairable with black RTV per standard procedures.

Two large notable tile damages were observed post flight. The first was to the V070-292102-066 tile that was cracked through to the SIP (refer to photo 28). The tile was removed and replaced. The second damage was to the V070-291216-007 tile that had an impact damage 2 inches by 0.6 inch by 0.5 inch, warranting removal and replacement as well. Several other tile damages were repaired per standard procedures.

5.3.5 OMS Pods

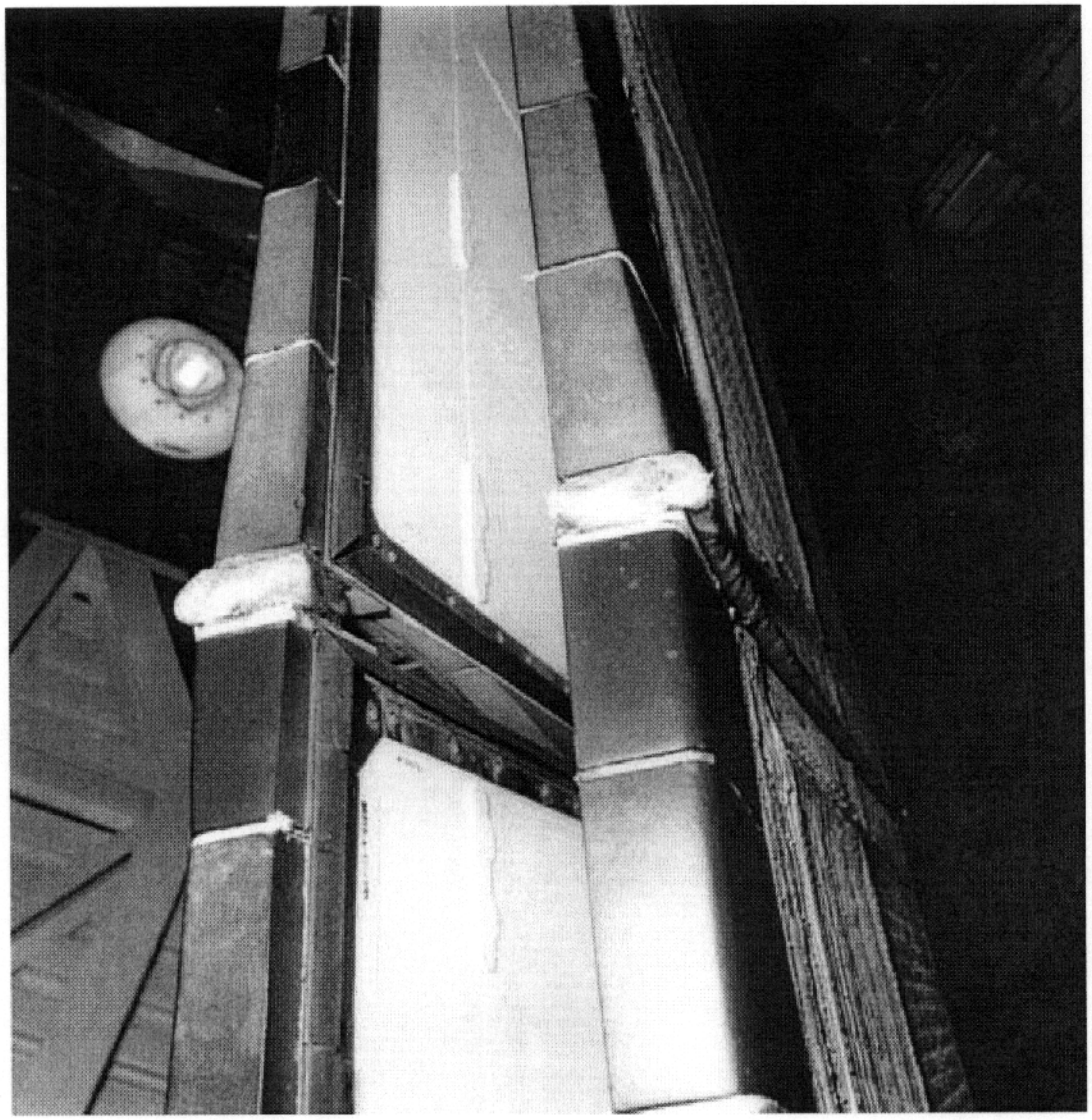
(X. Dominguez)

The TPS on both OMS pods performed satisfactorily compared to previous flights. No major anomalies were detected, with the exception of the right hand OMS where two pod blankets (V070-396376-052 and -054) were lifting from the leading edge of the blanket due to flight loads (refer to photo 29, photo 30, and photo 31). Both blankets were removed and replaced. Various other minor damages were repaired per standard procedures.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

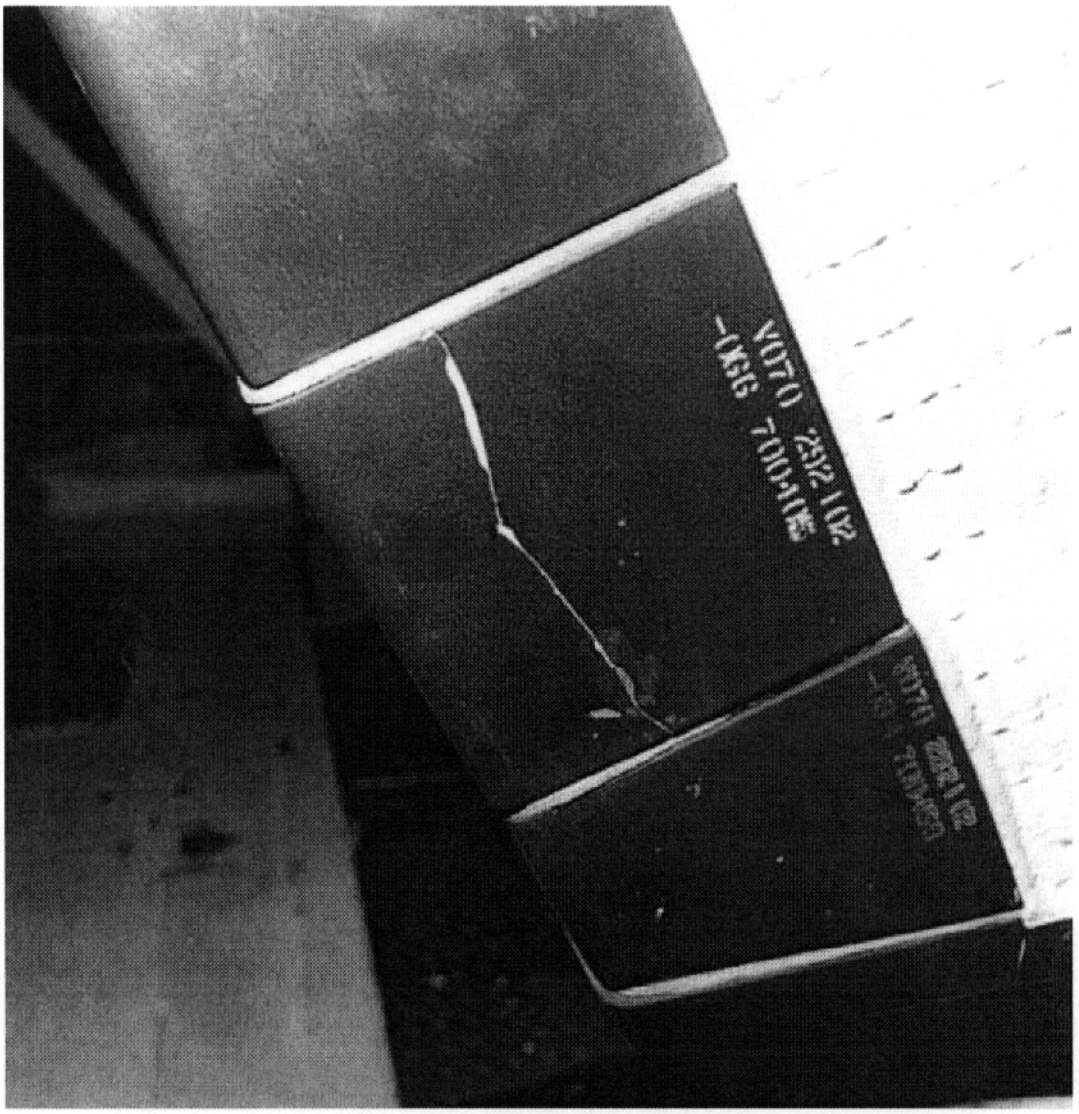


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 27. Split Line Thermal Barrier, Overall View

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

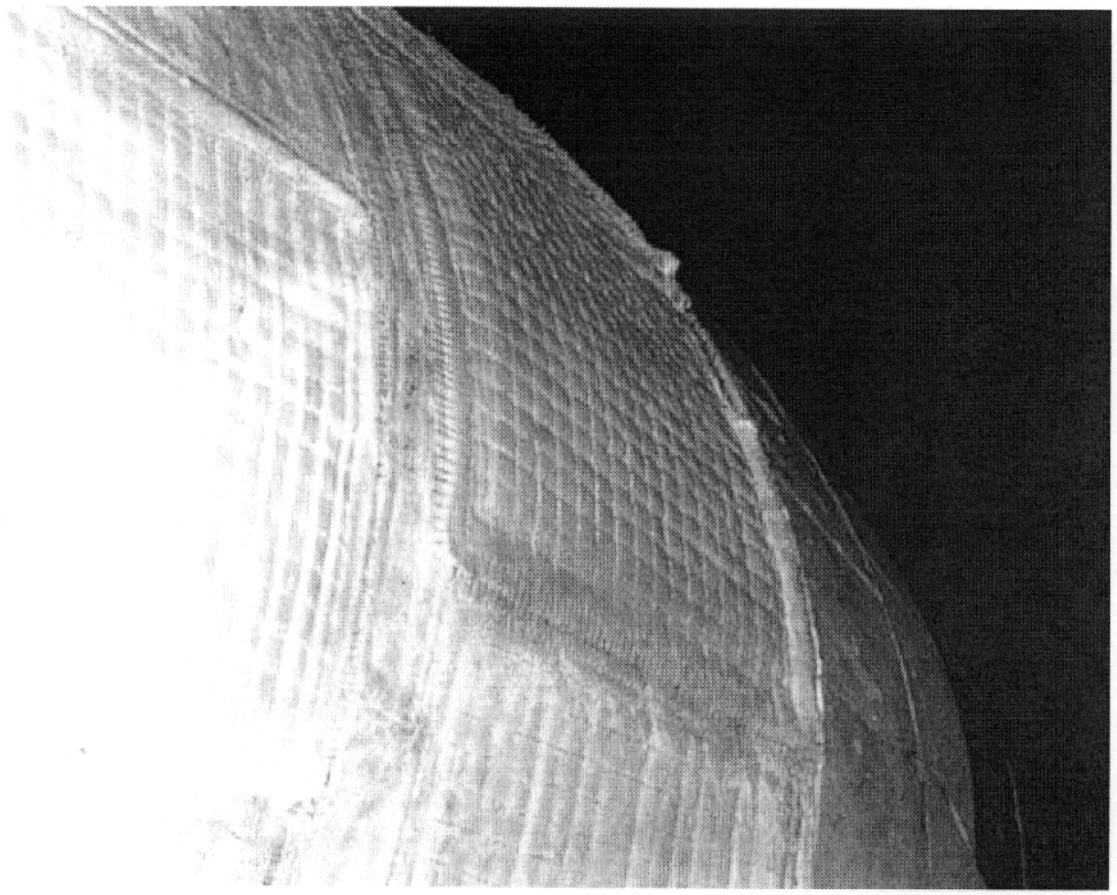


Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 28. Damaged Tile (V070-292102-066) on the Vertical Stabilizer

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms



Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 29. Lifting Leading Edge of Right Hand OMS Pod, Overall View

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 30. Lifting Leading Edge Blanket (V070-396376-052) of Right Hand OMS Pod

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Photo 31. Lifting Leading Edge Blanket (V070-396376-054) of Right Hand OMS Pod

This page intentionally left blank.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

6.0 *SPECIAL TOPICS*

6.1 *Restricted Paper Summary*

(C. Snapp)

A summary of documents and associated conditions that were accepted on a restricted/limited-life usage for flight 24 are listed in table 17. The post-flight 24 proposed action/work for each condition is also summarized in the table.

Table 17. Restricted Paper Summary for STS-98

WAD	PROBLEM/DISCREPANCY	PROPOSED REWORK
FWD-4-A0123	WINDOW 1, 2, 3, & 5 CARRIER PANELS OUT-OF-TOLERANCE FILLER BAR SEAL	MRB APPROVED FOR USE BASED ON THERMAL ENGINEERING EVALUATION
FWD-4-A0128	HRSI V070-391017-305 TILE APPEARED LOOSE DURING BOND VERIFICATION	REMOVE AND REPLACE TILE PRIOR TO FLIGHT 24
FWD-4-A0129	FI BLANKET V070-391139-037 HAD DAMAGE (1" BY 1") WITH LOOSE OML FABRIC AND EXPOSED BATTING	REPAIR AND EVALUATE FOR DEGRADATION AND POSSIBLE RE-RESTRICTION
FWD-4-A0130	AIR DATA PROBE AREA TILES (6) OUT-OF-TOLERANCE STEP AND GAP	RE-RESTRICT BASED ON THERMAL ENGINEERING EVALUATION
AFT-4-A0168	HRSI V070-395908-096 TILE IS CRACKED THROUGH TO SIP	REMOVE AND REPLACE TILE PRIOR TO FLIGHT 24
AFT-4-A0170	HRSI V070-395162-082 TILE IS CRACKED THROUGH TO SIP	REMOVE AND REPLACE TILE PRIOR TO FLIGHT 24
RSI-4-A004	FI BLANKET WATERPROOFING EVALUATION	DEFER TO OV-104 FLIGHT 25
RSI-4-A005	CARRIER PANEL EVALUATION/TORQUE CHECK	DEFER TO OV-104 FLIGHT 25
RSI-4-A0032	PPE REQUIREMENTS IN SPECS DO NOT COMPLY WITH USA REQUIREMENTS	EOTF RELEASE
RSI-4-A0035	71 TILES REPAIRED PER PROCESS TPS-368 - DEGRADATION CONCERN	RE-RESTRICT TO OV-104 FLIGHT 25; POST-FLIGHT INSPECTIONS WILL EVALUATE EACH TILE FOR POSSIBLE REMOVAL AND REPLACEMENT
RSI-4-A0036	PR GENERATED TO TRACK TILE WITH OUT-OF-TOLERANCE KEQ > 0.110 IN 30 LOCATIONS	RE-RESTRICT TO OV-104 FLIGHT 24
RWNG-4-A0087	OUT-OF-TOLERANCE STEPS	RE-RESTRICT TILE CONDITION FOR ADDITIONAL FLIGHT
TLP03-A0037	OUT-OF-TOLERANCE STEPS AND GAPS	AMES EVALUATION
TLP03-A0038	HRSI V070-396074-019 TILE IS CRACKED THROUGH TO SIP	REMOVE AND REPLACE TILE PRIOR TO FLIGHT 24
TLP03-A0039	10 TILES REPAIRED PER PROCEDURES TPS-368 - DEGRADATION CONCERN	RE-RESTRICT TO OV-104 FLIGHT 25; POST-FLIGHT INSPECTIONS WILL EVALUATE EACH TILE FOR POSSIBLE REMOVAL AND REPLACEMENT
TRP04-A0034	OUT-OF-TOLERANCE STEPS AND GAPS	AMES EVALUATION

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Table 17. Restricted Paper Summary for STS-98 (cont'd)

WAD	PROBLEM/DISCREPANCY	PROPOSED REWORK
TRP04-A0038	5 TILES REPAIRED - DEGRADATION CONCERN	DEFER TO OV-104 FLIGHT 24; POST-FLIGHT INSPECTIONS WILL EVALUATE EACH TILE FOR POSSIBLE REMOVAL AND REPLACEMENT
VERT-4-A0014	TILE IS CRACKED	RE-RESTRICT TO A FUTURE FLIGHT

6.2 Deferred/Partial Mods

(X. Dominguez)

There were no partial or deferred modifications to carry over from previous OV-104 missions.

6.3 Flight Demonstrations

(X. Dominguez)

There were no flight demonstrations for this mission of OV-104.

6.4 Significant Problems

There were no significant problems to report for this mission of 0V-104.

6.5 AETB-8/TUFI Performance

(X. Dominguez)

Post-flight inspection of AETB-8/TUFI tiles did not find any noticeable damage to the tiles.

7.0 Open Issues From Previous Report

(X. Dominguez)

Post-landing assessments on numerous vehicles that have found the internal batting of the V070-398374-001 barrier to be compressed/missing have been addressed with a design change authorized by the latest released EO to applicable drawings. The former design of the barrier, with a semi-closed out wagon wheel stitched end, did not provide sufficient protection to direct airflow impingement on the leading edge of the part. Opening of the NLG doors on final approach to landing speeds of 200+ mph repetitively resulted with compressed/missing batting at the end of the barrier. The released engineering for the new design has employed a fabric end cap that covers the entire forward facing portion of the barrier. This will prevent the direct impingement of airflow, mitigating the problem with the compressed/internal batting. The new redesigned thermal barrier configuration has been implemented on OV-104 during the post-flight 24 processing operations making flight 25 of OV-104 the first flight of this design.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

8.0 APPENDICES

8.1 STS-104 TPS Quick Look Runway Inspection, July 24, 2001

(X. Dominguez)

General

- Landed on KSC Runway 15 at 23:39 EDT, 24-Jul-01.
- Overall vehicle looked good.
- Access to vehicle was granted at approximately 00:24.
- No tiles were observed to be missing.
- One protruding Ames was observed on the lower surface.
- ET door hinges looked nominal.

Fwd

- Chin panel gap at time of access was 0.200 inch. Gap filler looked excellent with no frays.
- Two Ames gap fillers were found on the ground under the NLGD.
- Chin panel and nose cap looked good overall with no apparent white discoloration.
- OML damage on V070-391025-035 tile located on NLGD.
- Right hand V070-399042 gap filler was breached approximately 3 inches aft of the forward end of the gap filler.

Mid

- OML damage on V070-191035-078 and -025 on left hand side.
- OML damage on left hand LESS panel 4, V070-199706-062 tile.
- Protruding Ames gap filler on left hand wing between V070-191005-036 and -069 tiles.
- Two large OML damages on left hand wing V070-191005-029 tile.
- Molten deposit on right hand LESS panel 8 V070-199714-068 tile.
- Large OML damage on right hand MLGD V070-191121-024 structure side tile.

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms

Mid (cont'd)

- Four thermal barriers in the right hand MLGD cavity were observed to have torn fabric.
- Two thermal barriers in the left hand MLGD cavity were frayed.
- OML damage on V070-191003-244 tile.

Aft

- Broken corner on right hand ET door V070-395055-206 corner tile.
- Leading edge damage on V070-395055-216 right hand ET door tile.
- OML damage on approximately 6 tiles outboard of the right hand ET door.
- OML damage on approximately 6 tiles aft of the right hand ET door.
- Discoloration of finger on leading edge of right hand ET door.
- OML damage outboard of right hand ET door on V070-395037-153 tile.
- OML damage on body flap V070-193001-268 tile.
- Blanket damage on leading edge of right hand OMS Pod.
- Damaged dome heat shield blanket and pillow at 6 o'clock location on SSME number 1.
- Damaged dome heat shield blanket at 9 o'clock position on SSME number 2.
- Damaged pillow at 6 o'clock position on SSME number 3.
- Upper body flap appeared nominal except for normal peppering of aft base heat shield.

Runway inspection performed by:

SFOC SE: Charlie Romeo

NASA SE: Jennifer Gill

Boeing OE: Xavier Dominguez

Previous Page
Next Page
Table of Contents
List of Tables
List of Figures
List of Photos
List of Acronyms